



Curriculum Vitae di

Prest Michela

INFORMAZIONI PERSONALI

Cognome e Nome Prest Michela

Qualifica PhD in fisica
Amministrazione UNIVERSITÀ DEGLI STUDI DELL'INSUBRIA
Incarico attuale Professore Ordinario

E-mail istituzionale

TITOLI DI STUDIO E PROFESSIONALI ED ESPERIENZE LAVORATIVE

Titolo di studio

Altri titoli di studio e professionali
Esperienze lavorative e professionali (incarichi ricoperti)

- Dottorato in fisica con una tesi dal titolo "SYRMEP: alle frontiere della mammografia digitale"
- Laurea in fisica con una tesi dal titolo "Correlazioni Lambda-leptone in DELPHI: un metodo nuovo per la misura delle oscillazioni dei mesoni B⁰"
- First certificate e Proficiency
- Da novembre 2018, delegato del Rettore per comunicazione, orientamento e fundraising
- Da novembre 2018, vice presidente della Fondazione Provinciale della Comunità Comasca
- Da novembre 2017, coordinatore del percorso per l'acquisizione dei 24CFU negli ambiti antropo, psico, pedagogico e delle metodologie didattiche, necessari per il concorso per docenti della scuola secondaria
- Dal 23 gennaio 2017 al 31 agosto 2018 membro del Consiglio di Amministrazione dell'università degli Studi dell'Insubria
- Dal 2017 responsabile locale di INFN-MiB del progetto AXIAL sulla collimazione di particelle con cristalli
- Dal 2016 membro del progetto europeo ENUBET (Enhanced NeUtrino BEams from kaon Tagging - project ID 681647, ERC-CoG-2015)
- Da luglio 2015 a ottobre 2018 membro del Consiglio di Amministrazione della Fondazione Provinciale della Comunità Comasca
- Dal 2015 responsabile locale della sezione INFN di Milano Bicocca per il progetto CHANEL (sulla collimazione con cristalli e la produzione di radiazione)
- 23 gennaio 2014: vincitrice dell'abilitazione nazionale per professore associato e professore ordinario nel settore 02/A1 (fisica sperimentale delle interazioni fondamentali)
- Da luglio 2014 rappresentante dell'Insubria al tavolo Università – Imprese di Unindustria
- Da marzo 2014 rappresentante dell'Università degli Studi dell'Insubria nel tavolo tecnico sul welfare sociale della Fondazione Provinciale della Comunità Comasca dedicato alla dispersione scolastica; responsabile del tavolo sulle scuole aperte
- Nel periodo 2014-2015 responsabile locale della sezione INFN di Milano Bicocca per ICERAD (sulla collimazione con cristalli) e SQUOP (sullo sviluppo di Silicon PhotoMultiplier per ottica quantistica)
- Da dicembre 2013 rappresentante dell'Università degli Studi dell'Insubria nel Comitato di Gestione della Scuola di Como
- Dal 2013 membro del comitato fondatore della Scuola di Como e membro della commissione di selezione degli Allievi del primo anno
- Da febbraio 2013 a ottobre 2018, delegato del Rettore all'Orientamento
- Da novembre 2012 a dicembre 2016, membro del Senato Accademico
- Nel 2012 progetto selezionato per il supporto finanziario nel framework del Transnational Access per EU project AIDA GA no. 262025 per l'uso delle facility di test al CERN

- Nel periodo 2010 - 2012 responsabile locale del progetto FIBER-SPAD (capofila CNR-IMM Bologna) finanziato dall'Agenzia Spaziale Italiana nel framework dei progetti tecnologici per lo sviluppo della competitività industriale nel campo spaziale (ASI call DC-PRZ-2007-001)
- Nel periodo 2011-2013 responsabile locale di TWICE, progetto del gruppo V INFN dedicato allo sviluppo di Silicon PhotoMultiplier per calorimetria
- Dal marzo 2010 al gennaio 2012 delegato all'orientamento della Facoltà di Scienze MM FF e NN di Como (ora Dipartimento di Scienza e Alta Tecnologia)
- Settembre 2009: selezionata per un finanziamento nell'ambito di EuCARD-MICE-Transnational Access Program
- Dal 2008 al 2012 membro del CdA dell'Università dell'Insubria
- Dal 2005 membro della IEEE
- Nel periodo 2008-2013 responsabile locale per i progetti INFN riguardanti la fisica dei cristalli (NTAHCCC e COHERENT); nel 2009 è stata responsabile nazionale dell'INFN e deputy spokesperson del progetto UA9 per test di collimazione con cristalli sull'anello dell'SPS del CERN
- Nel periodo 2005-2007, responsabile per l'Unità di Como del progetto PRIN "Dosimetria real-time di fotoni e neutroni per radioterapia e BNCT (Boron Neutron Capture Therapy) con Linac clinici"
- Responsabile locale della sezione INFN di Milano (dal 2007 Milano Bicocca) per il progetto AGILE
- Responsabile del tracciatore a silicio-tungsteno del progetto AGILE (Astrorivelatore Gamma a Immagini LEggero); nel 2012, l'American Astronomical Society ha assegnato il Bruno Rossi Prize a Marco Tavani e al Team AGILE per la scoperta del gamma-ray flare dalla Crab Nebula
- Responsabile di tutti i fasci di calibrazione dei prototipi e del modello da volo di AGILE presso il CERN (Ginevra) e presso la BeamTest Facility dei Laboratori Nazionali dell'INFN di Frascati
- Instrument Scientist di AGILE e come tale membro dell'ASB (AGILE Science Board)
- Dal 2000 al 2004, responsabile locale della sezione INFN di Trieste per il progetto AGILE

Tipo di attività o settore **Attività didattica**

- A partire dal 2003, è docente di diversi corsi nell'ambito del Corso di Laurea triennale e magistrale in Fisica: Laboratorio di Fisica II (a.a. 2003-2004), Laboratorio di Fisica III (dall'a.a. 2002-2003 al 2018-19), assistente al Laboratorio di Fisica IV (dall'a.a. 2003-2004 al 2006), Elettronica I e Fisica dei Rivelatori (dall'a.a. 2004-2005; dall'a.a. 2018-19 Applied Electronics e Radiation and detectors), Laboratorio IV (dal 2006-2007 al 2010/11, dal 2015-2016 ad ora), Laboratorio di Fisica Subnucleare e Medica (dal 2014-15 al 2017-18). Inoltre dall'a.a. è titolare del corso di fisica per il corso di laurea triennale in Biotecnologie.
- Dal 2005, è stata relatrice di 24 tesi di laurea di primo livello, 33 di secondo livello e tutore di 7 tesi di dottorato in ambiti che vanno dalla fisica medica alla fisica delle particelle e dei rivelatori.

Attività scientifica

L'attività di ricerca ha spaziato su diversi temi:

- progettazione, costruzione e test di rivelatori al silicio e della relativa elettronica di frontend e di lettura
- progettazione, costruzione e test di sistemi di rivelazione basati su rivelatori al silicio e su scintillatori e dedicati alla fisica delle alte energie, alla fisica medica e alla fisica dello spazio
- sviluppo di software e di sistemi di acquisizione dati
- analisi dati

Durante il periodo di tesi, si è occupata di analisi all'interno del gruppo **DELPHI**, in cui, nell'anno successivo alla laurea, è stata responsabile dell'installazione dei rivelatori al silicio del luminometro a piccolo angolo, lo STIC.

A partire dal periodo di dottorato, la sua attività si è centrata sull'esperimento SYRMEP, e in particolare su tutti gli aspetti hardware e software concernenti il rivelatore e l'elettronica.

SYRMEP (*Synchrotron Radiation for Medical Physics*) si inserisce nella nuova tendenza nel campo della radiologia diagnostica in generale e in quello della tecnica mammografica in particolare, tendenza consistente nello sviluppo e nell'utilizzo di sistemi d'indagine interamente digitali, che permettano, in linea di principio, di ottimizzare separatamente le azioni di acquisizione, visualizzazione e conservazione dell'immagine. Lo scopo di tali sistemi risiede nel superamento dei limiti intrinseci della tecnica mammografica standard (lastra+tubo a raggi X): alte dosi rilasciate alle pazienti, diminuzione del contrasto dovuto alla radiazione diffusa, bassa efficienza di rivelazione dei fotoni incidenti. SYRMEP ha agito su tutti gli elementi dell'esame mammografico: sulla sorgente, sostituendo il tubo standard con un

fascio monocromatico e laminare di luce di sincrotrone, e sul recettore d'immagine, costruendo al posto della lastra un rivelatore completamente digitale basato sui rivelatori a strip di silicio comunemente usati in fisica delle particelle elementari. Attualmente la linea SYRMEP è evoluta in una linea per pazienti.

Dal 1997 al 2000, inoltre, all'interno della collaborazione **FRONTRAD** (*FRONTier RADIography*), naturale evoluzione di SYRMEP, è stata responsabile della progettazione del nuovo ASIC di frontend e del nuovo rivelatore al silicio, con lo scopo di riuscire ad effettuare una mammografia in un tempo inferiore a 10 sec. Dal 1998 al 2007 ha fatto parte della collaborazione **AGILE** e dal 1999 è stata responsabile del tracciatore a silicio-tungsteno del satellite. Lo scopo di AGILE, prima Piccola Missione Scientifica finanziata dall'ASI (Agenzia Spaziale Italiana), era quello di costruire uno strumento per l'osservazione di raggi gamma con energia compresa tra 30MeV e 50GeV, strumento leggero (circa 100kg) e con un ampio campo di vista (circa 1/4 dell'intero cielo). AGILE ha volato per parte del tempo in un periodo in cui non era prevista nessun'altra missione per l'osservazione di raggi gamma, con energia superiore ai 30MeV. Dal 2000, è stata responsabile anche di tutti i periodi di test su fascio dei prototipi e del modello da volo; in particolare è stata responsabile della realizzazione di una linea di produzione di fotoni taggati tramite bremsstrahlung di elettroni presso il CERN di Ginevra e ha seguito la realizzazione di una linea di photon tagging analoga (a energie più basse) presso la BTF di Frascati. Il satellite AGILE è stato lanciato dall'India il 23 Aprile 2007 e ha prodotto una mole notevole di risultati scientifici. Nel 2012, l'American Astronomical Society ha assegnato il Bruno Rossi Prize a Marco Tavani e al Team AGILE per la scoperta del gamma-ray flare dalla Crab Nebula.

Dal 2003 al 2005, ha partecipato all'attività di ricerca della collaborazione **SUCIMA** (*Silicon Ultra Fast Cameras for Electron and Gamma Sources in Medical Applications*) presso l'Università dell'Insubria, un progetto approvato nel quinto programma quadro dell'Unione Europea (E.C. Contract N. G1RD-CT-2001-00561), occupandosi dello sviluppo, integrazione e presa dati del rivelatore a strip di silicio con ASIC a integrazione. Tale progetto si proponeva lo sviluppo di un sistema di imaging avanzato per sorgenti radioattive estese usate in campo medico. Due erano le applicazioni previste: la brachiterapia intravascolare e il monitoraggio real-time di fasci di protoni e ioni leggeri per trattamenti adro-terapici. Il dosimetro sviluppato è costituito da un rivelatore a pixel con elettronica integrata (CMOS imager); nella fase di prototipaggio, test estensivi su sorgenti brachiterapiche sono stati effettuati utilizzando il rivelatore a strip disegnato da lei stessa nell'ambito del progetto AGILE.

Dal 2005, collabora con il gruppo di Brescia dell'esperimento **ASACUSA** (CERN) per la progettazione e la costruzione del tracciatore a fibre scintillanti di un esperimento di annichilazione protone-antiprotone. Il tracciatore ha completato il commissioning e diversi fasi di presa dati si sono già svolte presso l'Antiproton Decelerator del CERN. Partendo da questa esperienza, si è occupata dell'elettronica di frontend e di readout del tracciatore a barre scintillanti di MUSASHI-CUSP TRAP per lo studio della produzione dell'antimateria.

Dal 2006 al 2009, ha fatto parte della collaborazione **H8RD22** del CERN per lo studio del channeling di particelle di alta energia in cristalli di silicio curvato allo scopo di costruire dei collimatori di seconda generazione per eliminare l'alone del fascio del collider protone-protone LHC (CERN). In quest'ambito, è stata uno dei due proponenti dell'esperimento UA9 (approvato dal Research Board del CERN nel settembre 2008), dedicato al test dei cristalli sull'alone del fascio dell'SPS del CERN per una successiva applicazione in LHC. Dal 2009, conduce studi di possibili sorgenti di fotoni realizzate con il passaggio di particelle leggere in cristalli in configurazione di channeling o riflessione di volume (**COHERENT**, **ICERAD**, **CHANEL** - INFN). Nel 2013 il gruppo ha realizzato la prima misura al mondo di channeling planare e di riflessione di volume di elettroni da 855MeV con un cristallo di silicio di 30.5µm di spessore nella direzione del fascio.

Nel periodo 2008-2012, ha collaborato con il progetto **MICE** (*Muon Ionization Cooling Experiment*) per lo studio di fattibilità di una neutrino factory, occupandosi del disegno e della realizzazione dell'elettronica dell'Electron Muon Ranger, un tracciatore-calorimetro per l'identificazione degli elettroni derivanti dal decadimento dei muoni per una misura precisa dell'emittanza.

Nel periodo 2008-2011 ha collaborato con il progetto **FACTOR** dell'INFN, occupandosi del test di calorimetri e di tracciatori a barre di scintillatore letti con Silicon PhotoMultiplier; nel periodo 2011-2013 ha fatto parte della collaborazione **TWICE** per lo sviluppo di SiPM per applicazioni calorimetriche a terra e spaziali. Dal 2015, grazie all'esperienza sviluppata in FACTOR e TWICE, è membro del progetto **SCENTT** (*Shashlik Calorimeters for Electron Neutrino Tagging and Tracing*) e dal 2016 del progetto **ENUBET**, dedicati alla possibilità di misurare in modo diretto il flusso di neutrini abbattendo di conseguenza di un ordine di grandezza le incertezze sistematiche sulle sezioni d'urto dei neutrini. ENUBET intende misurare il flusso di positroni prodotti nel decadimento $K^+ \rightarrow e^+ \pi^0 \nu_e$ (Ke3) in un tunnel di decadimento corto (50m per secondari di 8GeV) in cui Ke3 rappresenta l'unica fonte di ν_e . Il gruppo di Como si occupa dello sviluppo di un positron-tagger basato su calorimetri shashlik con campionamento longitudinale letti da Silicon PhotoMultiplier capaci di sostenere un rate di 500kHz/cm².

I SiPM sviluppati da TWICE sono attualmente usati dal gruppo di Como per sviluppare un dosimetro per fasci radioterapici di fotoni ed elettroni basato su fibre scintillanti e SiPM a grande range dinamico. Il dosimetro prevede anche la presenza di fibre drogate al boro per la rivelazione della contaminazione neutronica in fasci di fotoni di alta energia.

Per quanto riguarda le attività nell'ambito della **Fisica Medica**, è stata responsabile dell'unità di Como per il progetto supportato dal PRIN05 sullo sviluppo di un dosimetro real time per elettroni, fotoni e neutroni da linac radioterapici. Il progetto ha sviluppato un dosimetro real time multicanale basato su fibre scintillanti lette da fotomoltiplicatori multianodo.

Ha fatto parte del progetto dell'INFN PhoNeS che ha gettato le basi dello sviluppo di una sorgente di neutroni utilizzando linac radioterapici per la BNCT (Boron Neutron Capture Therapy) in un reparto ospedaliero. I neutroni sono prodotti per Risonanza di Dipolo Gigante da un fascio di fotoni di alta energia (>8MeV). PhoNeS ha simulato, realizzato e testato un primo prototipo di convertitore+moderatore per aumentare la frazione di neutroni lenti (energia <10keV) riducendo la dose gamma al paziente.

La BNCT sfrutta la reazione di cattura di neutroni termici da parte del Boro-10 producendo una particella alfa e un nucleo di litio che si fermano praticamente dove sono stati prodotti (cioè nella cellula che ha assorbito il B-10). Attualmente è praticata (e in rari casi) solo presso i reattori nucleari a causa dei flussi e delle energie in gioco, ma potrebbe rivelarsi l'arma vincente per alcuni tipi di tumore quali quelli estesi, quelli localizzati vicino agli organi vitali e quelli radio-resistenti.

Nell'ambito di questo progetto, il gruppo ha misurato le caratteristiche del campo neutronico con il metodo dell'attivazione, utilizzando sia singoli campioni di Al e rivelatori allo NaI sia una matrice di CsI, prototipo del rivelatore PIXIT. Utilizzando il fascio di neutroni così prodotto e un rivelatore a microstrip di silicio non svuotato (basato sul rivelatore di AGILE) operato in modalità real time, sono state realizzate curve cinetiche con sangue e urine (per la prima volta non su reattore) per la misura dell'uptake del boro da parte del corpo in funzione del tempo dalla somministrazione per pazienti trattati con BNCT. In collaborazione con l'Ospedale S. Luigi di Orbassano (To), con l'INFN di Trieste e di Torino e con diverse altre realtà universitarie, curve analoghe sono state misurate per il sangue con cui è stato perfuso (insieme a una soluzione del carrier del boro) un lobo di polmone espantato e mantenuto in vita per qualche ora.

Attività di outreach

- Dal 2005: membro del Progetto Lauree Scientifiche per fisica
- Dal 2012: partecipa al programma "Alternanza Scuola – Lavoro" del MIUR
- Dal 2013: membro del comitato organizzatore di MEETmeTONIGHT – La Notte dei Ricercatori
- Nel 2005: membro del comitato organizzatore della mostra "La fisica attorno a noi: come 100 anni di scoperte hanno cambiato la vita quotidiana"; l'esibizione è stata organizzata su un'area di 600m2 ed ha visto la partecipazione di oltre 10000 visitatori nel periodo 15/12/2005 – 15/01/2006
- Dal 2010: corsi di aggiornamento per i docenti di tutti i livelli scolastici
- Dal 2012: organizzazione di laboratori scientifici per le scuole di ogni ordine e grado

CAPACITÀ LINGUISTICHE

Lingua	Livello Parlato	Livello Scritto
Italiano (nativo)		
Inglese	Ottimo	Ottimo

CAPACITÀ NELL'USO DELLE TECNOLOGIE

IT technologies:

- Sistemi operativi: Linux, Windows.
- Linguaggi di programmazione: Fortran, C, C++.
- Programmi:
 1. scrittura: Latex, Word, OpenOffice.
 2. CAD elettronici: Cadence, Quartus II
 3. simulazione di circuiti: SPICE.

Sistemi di acquisizione dati: CAMAC, VME, GPIB.

ALTRO (partecipazione a convegni e seminari, pubblicazioni, collaborazioni a riviste, ecc, ed ogni altra

Conferenze:

- nel 2004, membro del comitato organizzatore del Workshop Vertex 2004 (Menaggio, 13-18/9/2004) e topic convener delle sessioni di "Astrophysics and Space Instrumentation" per la 2004 IEEE NSS Conference (Roma, 16-22/10/2004).
- ha partecipato a diverse conferenze internazionali con relazioni su invito

informazione che si ritiene di dover pubblicare)

Pubblicazioni:

- è reviewer per la rivista Nuclear Instruments and Methods in Physics Research A
- fa parte del comitato di selezione degli articoli per il Nuclear Science Symposium della IEEE
- è autore di oltre 350 pubblicazioni su riviste internazionali (Hindex = 47, nr di citazioni = 9946); per consultare l'elenco si veda il seguente link: <https://irinsubria.uninsubria.it/simple-search?query=prest#.V-kEoNERjyw>

Como, 06/04/2022

Firma

Curriculum Vitae di Carlo Ferraresi

Carlo Ferraresi ha conseguito la Laurea Magistrale in Ingegneria Meccanica presso il Politecnico di Torino nel 1980. Dal 1983 ha operato presso il Dipartimento di Meccanica del Politecnico di Torino, oggi Dipartimento di Ingegneria Meccanica e Aerospaziale, come Ricercatore Universitario, poi dal 1992 come Professore Associato e dal marzo 2000 Professore Ordinario di Meccanica Applicata.

IMPEGNI DIDATTICI E ACCADEMICI

- Docente regolare di Meccanica ingegneristica di base, Meccanica applicata alle macchine, Meccanica dei robot, Meccanica e controllo dei sistemi meccanici, Meccanica dei sistemi biomedici.
- Autore di diversi libri di testo sulla meccanica applicata, l'automazione a fluido e il controllo dei sistemi meccanici.
- 1999-2001 - Vicepresidente del Corso di Diploma Universitario in Ingegneria Meccanica.
- 1999-2012 - Coordinatore del Collegio di Dottorato in Meccanica Applicata.
- 2003-2012 - Vice Preside della I Facoltà di Ingegneria.
- 2016-2023 - Presidente del Comitato Tecnico per l'Ingegneria Biomeccanica di IFToMM (International Federation for the promotion of Mechanism and Machine Science).
- 2019-2020 - Presidente del Comitato Scientifico Internazionale di RAAD (Robotics in Alpe-Adria-Danube Region).
- 2020-2023 - Vice Direttore del Dipartimento di Ingegneria Meccanica e Aerospaziale.

RICERCA

I principali argomenti di ricerca sono: automazione, robotica, mecatronica, trasmissioni a fluido e ingegneria biomeccanica.

Il Prof. Ferraresi è membro di diversi comitati editoriali e frequente revisore di numerose riviste e convegni scientifici. È inoltre revisore per diverse organizzazioni di finanziamento nazionali e internazionali. Ha guidato diversi progetti di ricerca finanziati da MURST/MIUR, CNR, ASI e il British Council. Ha partecipato a numerose collaborazioni di ricerca tra il Politecnico di Torino e aziende pubbliche e private. Dal 2016 è associate alla sezione di Torino dell'INFN (Istituto Nazionale di Fisica Nucleare).

L'attività di ricerca ha portato alla pubblicazione di oltre 280 articoli scientifici su riviste e atti di convegni nazionali e internazionali, nonché al deposito di 15 brevetti industriali.

Pubblicazioni recenti

- Quaglia, G., Ferraresi, C., Franco, W. Float-Ram: A Sustainable Machine for Buildings Made by Compressed Earth Blocks (2022) *Mechanisms and Machine Science*, 108 MMS, pp. 99-109.
- Ferraresi, C., Franco, W., Maffiodo, D., De Benedictis, C., Paterna, M., Pacheco Quiñones, D., Ermini, L., Roatta, S. Applications of Intermittent Pneumatic Compression for Diagnostic and Therapeutic Purposes (2022) *Mechanisms and Machine Science*, 108 MMS, pp. 209-218.
- Ferraresi, C., De Benedictis, C., Bono, L., Del Gaudio, F., Ferrara, L., Masiello, F., Franco, W., Maffiodo, D., Leardini, A. A methodology for the customization of hinged ankle-foot orthoses based on in vivo helical axis calculation with 3D printed rigid shells (2021) *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*, 235 (4), pp. 367-377.
- Cavallaro, L., Tessari, F., Milandri, G., De Benedictis, C., Ferraresi, C., Laffranchi, M., De Michieli, L. Finite element modeling of an energy storing and return prosthetic foot and implications of stiffness on rollover shape (2021) *Proceedings of the Institution of Mechanical Engineers, Part H: Journal of Engineering in Medicine*.

- Magnetti Gisolo, S., Muscolo, G.G., Paterna, M., De Benedictis, C., Ferraresi, C. Feasibility study of a passive pneumatic exoskeleton for upper limbs based on a mckibben artificial muscle (2021) *Mechanisms and Machine Science*, 102, pp. 208-217.
- Ferraresi, C., De Benedictis, C., Muscolo, G.G., Pica, O.W., Genovese, M., Maffiodo, D., Franco, W., Paterna, M., Roatta, S., Dvir, Z. Development of an automatic perturbator for dynamic posturographic analysis (2021) *Mechanisms and Machine Science*, 93, pp. 273-282.
- Ermini, L., Chiarello, N.E., De Benedictis, C., Ferraresi, C., Roatta, S. Venous Pulse Wave Velocity variation in response to a simulated fluid challenge in healthy subjects (2021) *Biomedical Signal Processing and Control*, 63, art. no. 102177, .
- Ferraresi, C., Maffiodo, D., Franco, W., Muscolo, G.G., De Benedictis, C., Paterna, M., Pica, O.W., Genovese, M., Quiñones, D.P., Roatta, S., Dvir, Z. Hardware-in-the-loop equipment for the development of an automatic perturbator for clinical evaluation of human balance control (2020) *Applied Sciences (Switzerland)*, 10 (24), art. no. 8886, pp. 1-17.
- Dvir, Z., Paterna, M., Quargnenti, M., De Benedictis, C., Maffiodo, D., Franco, W., Ferraresi, C., Manca, A., Deriu, F., Roatta, S. Linearity and repeatability of postural responses in relation to peak force and impulse of manually delivered perturbations: a preliminary study (2020) *European Journal of Applied Physiology*, 120 (6), pp. 1319-1330.
- Ermini, L., Ferraresi, C., De Benedictis, C., Roatta, S. Objective Assessment of Venous Pulse Wave Velocity in Healthy Humans (2020) *Ultrasound in Medicine and Biology*, 46 (3), pp. 849-854.
- Bottero, S., Muscolo, G.G., Ferraresi, C. A new soft RCC device with pneumatic regulation (2020) *Robotics*, 9 (4), art. no. 98, pp. 1-12.
- Sartirana, D., Calvo, D., Capirossi, V., Ferraresi, C., Iazzi, F., Pinna, F., for NUMEN collaboration Target Manipulation in Nuclear Physics Experiment with Ion Beams (2020) *Mechanisms and Machine Science*, 84, pp. 535-543.
- Maffiodo D., Franco W., De Benedictis C., Paterna M., Muscolo G.G., Roatta S., Ferraresi C., Dvir Z., (2020) Pneumo-tronic Perturbator for the Study of Human Postural Responses. In: Berns K., Görge D. (eds) *Advances in Service and Industrial Robotics. RAAD 2019. Advances in Intelligent Systems and Computing*, vol 980. Springer, Cham
- Ermini L., Ferraresi C., De Benedictis C., Roatta S., Objective Assessment of Venous Pulse Wave Velocity in Healthy Humans - In: *ULTRASOUND IN MEDICINE AND BIOLOGY*. - ISSN 0301-5629. - 46:3(2020), pp. 849-854. Ferraresi C., De Benedictis C., Maffiodo D., Franco W., Peluso A., Leardini A. (2019) A methodology for the development of a Hinged Ankle-Foot Orthosis compatible with natural joint kinematics. In: Uhl T. (eds) *Advances in Mechanism and Machine Science. IFToMM WC 2019. Mechanisms and Machine Science*, vol 73. Springer, Cham
- Franco W., Ferraresi C., Revelli R., Functional Analysis of Piedmont (Italy) Ancient Water Mills Aimed at Their Recovery or Reconversion. *Machines*. 2019; 7(2):32.
- Franco W., Ferraresi C., Giordano P., Quaglia G. (2019) Functional Analysis of an Animal-Drawn Reaper-Binder. In: Uhl T. (eds) *Advances in Mechanism and Machine Science. IFToMM WC 2019. Mechanisms and Machine Science*, vol 73. Springer, Cham
- Ferraresi C., De Benedictis C., Maffiodo D., Franco W, Messere A., Pertusio R., Roatta S., Design and Simulation of a Novel Pneumotronic System Aimed to the Investigation of Vascular Phenomena Induced by Limb Compression. *J Bionic Eng* 16, 550–562 (2019). <https://doi.org/10.1007/s42235-019-0045-0>
- Franco W., Maffiodo D., De Benedictis C., Ferraresi C., Use of McKibben Muscle in a Haptic Interface. *Robotics*. 2019; 8(1):13.
- Franco W, Ferraresi C, Revelli R. Power transmission and mechanisms of an old water mill. *Mech Mach Sci* 2019;68:29-37.

STUDI

Luglio 1996 **Politecnico di Torino:** Laurea in Ingegneria Aeronautica
Ottobre 1996 **Esame di stato** di Abilitazione all'esercizio della professione di Ingegnere.

RUOLI ATTUALMENTE RICOPERTI

- Responsabile del Servizio di Progettazione Meccanica della Sezione dell'INFN di Torino;
- Coordinatore Nazionale del WP3 del Progetto UE BrightnESS2;
- Responsabile della progettazione meccanica del Drift Tube LINAC (DTL) di European Spallation Source (ESS);
- Coordinatore locale del gruppo di lavoro per fornitura DTL di ESS;
- Mechanical System Engineer nella collaborazione IXPE;
- Technical coordinator del Di-Muon Spectrometer dell'esperimento ALICE in LHC;
- Coordinatore locale del gruppo di lavoro per fornitura di Quadrupolo in RadioFrequenza (RFQ) dell'esperimento IFMIF-EVEDA.

ESPERIENZA PROFESSIONALE

1996-1997 **Dipartimento di Ingegneria Aeronautica e Spaziale del Politecnico di Torino:** contratto di collaboratore per "Progettazione e sviluppo di una piattaforma bi-rotorica a controllo remoto", in qualità di responsabile delle prove in galleria del vento, della progettazione della trasmissione e dell'analisi di stabilità, nel periodo dal 02/09/1996 al 31/10/1997;

1998 **Divisione Tecnica dell'Amministrazione Provinciale di Cuneo – Settore Risorse Idriche:** servizio militare nel periodo dal 12/02/1998 al 09/09/1998;

1998- 2000 **Istituto Nazionale di Fisica Nucleare di Torino:** associazione tecnologica con borsa di studio su "Progettazione della struttura meccanica delle camere RPC e del rivelatore ZDC dell'esperimento ALICE" (bando n. 6439/96), nel periodo dal 11/09/1998 al 10/09/2000;

2000 **Dipartimento di Fisica Sperimentale dell'Università di Torino:** contratto di collaboratore "Progettazione della struttura meccanica di una stazione di test per rivelatori RPC di grandi dimensioni", nel periodo dal 11/09/2000 al 13/10/2000;

2000-2019 **Istituto Nazionale di Fisica Nucleare di Torino:** Tecnologo T3, dipendente INFN a tempo indeterminato, presso il Servizio Progettazione Meccanica della Sezione di Torino;

2019 – oggi **Istituto Nazionale di Fisica Nucleare di Torino:** Primo Tecnologo T2, presso il Servizio Progettazione Meccanica della Sezione di Torino.

PUBBLICAZIONI:

- 33 Articoli su rivista;
- 7 Technical Design Report;
- 5 Internal Note / Letter of Intent;
- 42 Proceedings su rivista;
- 2 Capitoli su libro.

CONTRIBUTI A CONFERENZE:

Maggio 2015 **ALICE Muon Meeting 2015**, Domus de Maria (CA), 25-29 maggio 2015 – membro del comitato scientifico organizzatore (<https://agenda.infn.it/conferenceDisplay.py?confId=9307>);

Maggio 2016 Presentazione Poster a **7th International Particle Accelerator Conference (IPAC 2016)**, Busan, Korea, "ESS DTL Mechanical Design and Prototyping", (P. Mereu et al.), WEPMB008;

Maggio 2016 Presentazione Poster a **7th International Particle Accelerator Conference (IPAC 2016)**, Busan, Korea, "Mechanical Integration of the IFMIF-EVEDA Radio Frequency Quadrupole", (P. Mereu et al.), THPMY025;

Novembre 2016 **Workshop on IKC Best Practice – WP2 BrightnESS**, Bilbao, 14-15 novembre 2016 – invited talk "CAD and Standards in INFN Collaboration Projects"; (<https://brightness.esss.se/in-kind-best-practices/workshop-ikc-best-practice-bilbao>);

Settembre 2017 Presentazione Poster a **28th International Linear Accelerator Conference (LINAC16)**, East Lansing, Michigan (USA), "Preparation and Installation of IFMIF-EVEDA RFQ at Rokkasho Site", (E. Fagotti et al.), THPLR066.

DESCRIZIONE SINTETICA DELL'ATTIVITÀ INFN

1999 - 2010 Tecnologo meccanico **responsabile**, fino al completamento e messa in funzione, del rivelatore di Trigger per lo spettrometro per muoni e dello ZDC dell'esperimento ALICE in LHC, CERN;

1999 ad oggi Tecnologo meccanico **responsabile**, fino al completamento e messa in funzione, del rivelatore di Trigger per lo spettrometro per muoni e dello ZDC dell'esperimento ALICE in LHC, CERN; attualmente **Technical Coordinator**;

2004 **Progettista** della linea di produzione di Torino delle camere a *drift* per i rivelatori a muoni del *barrel* di CMS;

2007 **Progettista** di sistema meccanico motorizzato per tomografia su manufatti artistici per Centro di Conservazione e Restauro di Venaria Reale;

2008-2010 Tecnologo meccanico **progettista** per sistema a movimentazione motorizzata multi-asse per *test beam* nell'ambito del progetto SLIM5;

2008-2010 Tecnologo meccanico **progettista** nella collaborazione del *Silicon Vertex Tracker* di SuperB;

2008-2010 Tecnologo meccanico **progettista** nella collaborazione del Silicon Tracker di International Linear Collider;

2008 ad oggi **Coordinatore responsabile** del gruppo INFN di Torino per la costruzione della cavità RFQ del progetto IFMIF-EVEDA;

2009 ad oggi **Technical Coordinator** dello spettrometro per muoni dell'esperimento ALICE in LHC;

2009 ad oggi **Technical Coordinator** del sistema ZDC dell'esperimento ALICE in LHC;

2009-2013 **Responsabile** del *WorkPackage* di meccanica del progetto di ricerca neuART "*Neutron and x-ray tomography and imaging for cultural heritage*";

2011-2012 Tecnologo meccanico **responsabile** dei disegni esecutivi del criostato di CUORE e controllo della produzione;

2013 ad oggi **Coordinatore responsabile** del gruppo INFN di Torino per il *Drift Tube LINAC* di *European Spallation Source*;

2013 ad oggi **Responsabile** della progettazione meccanica del *Drift Tube LINAC* di *European Spallation Source*;

2015-2018 **In Kind Field Coordinator** per WP2 e WP6 del Progetto BrightnESS (H2020-INFRADEV-1-2015-1, G.A. n. 676548);

2016 ad oggi **Tecnologo meccanico** in IXPE;

2016 ad oggi **Responsabile** del Servizio di Progettazione Meccanica della sezione di Torino dell'INFN;

2019-2022 **Coordinatore Nazionale** per WP3 del Progetto BrightnESS-2 (H2020-INFRADEV-2018-1 G.A. n. 823867).

Torino, 30.06.2022

Paolo MEREU

Curriculum Vitae

Name: Tumino Aurora

Nationality: Italian

Education

- Graduate university: Università di Catania, Catania, Italy (1995) - 110/110 cum laude
- Ph.D.: Università di Catania, Catania – Italy (2000) cum laude

Current Academic Position

Full Professor of Physics at the Università degli Studi di Enna “Kore”, Italy (2014-present)

Positions held

- Fellowship, by Istituto Nazionale di Fisica Nucleare - Laboratori Nazionali del Sud (1995)
- Grant by Centro Siciliano di Fisica Nucleare e Struttura della Materia (CSFNMSM) (1996)
- Post Doctoral grant by CSFNMSM (2000)
- Alexander von Humboldt Post Doctoral Fellowship (HMI–Berlin, Germany) (2000-2001)
- Lindau Alumnus selected to attend the Lindau Nobel Laureate meeting (2001)
- Research contract at the Università degli Studi di Catania, Italy (2001 – 2005)
- Research contract at the Università degli Studi di Catania, Italy (2005-2007)
- Researcher at the Università degli Studi di Enna “Kore”, Italy (2008 – 2011)
- Associate Professor at the Università degli Studi di Enna “Kore”, Italy (2011 – 2014)

Membership of Committees

University level

2008-present Member of the board of Graduate School in Engineering

2008-present Member of the OFA evaluation committee

2008-present Member of the evaluation committee for the starting knowledge assessment

2008-present Member of the teaching staff of the PhD course in "ARCHITECTURE OF SYSTEMS FOR MOBILITY"

2008-present Member of Graduate Studies Committees

2008-present Member of Degree Commissions for the Degree courses of the Faculty of Engineering and Architecture

2009-2011 Coordinator of the first level and specialization degree courses in Telematic Engineering

2011-2019 Deputy Coordinator of the degree courses in Telematic Engineering

2009-present Member and chair of many committees for PhD graduation, temporary and permanent positions and promotions.

2016-present "External Examiner" in several international Committees for PhD graduation and promotions

2011-2012 Scientific Coordinator of the Advanced Level Master in “Efficienza Energetica e Risorse Energetiche Alternative” (CIP 2007.IT.051.PO.003/IV/I2/F/9.2.14/1395, CUP n. G75I10000170009 total funding 359.566 €)

2011-2017 Member of the parithetic Committee for the Faculty of Engineering and Architecture
2019-present Member of the Ethics Committee of the University

Scientific level

1994-present Associated Researcher at Laboratori Nazionali del Sud – INFN
2011-present Member of the Program Advisory Committee (PAC) of the "Institut de Physique Nucleaire", Orsay, Paris, France
2011-present Member of the external review panel of STFC (Science and Technology Facilities Council) of the Ernest Rutherford Advanced Fellowships
2012-present Member of the external review panel of Leverhulme Early Career Fellowships
2014-present Research Appointment at INFN – LNS
2014-present Member of the external review panel of NSERC (Natural Sciences and Engineering Research Council of Canada)-Discovery Grant Division
2015-present Member of the external review panel of NSF (National Science Foundation)
2015-present Member of the Working Group 4 "Nuclear Astrophysics" of the NuPECC (Nuclear Physics European Collaboration Committee)
2016-present Member and chair of Selection Committees for temporary, permanent positions and promotions inside the INFN
2016-present Member of the reviewer pool of the Italian National Agency for the Evaluation of Universities and Research Institutes (ANVUR) for the Italian Evaluation of the Research Quality
2017-present Member of the Program Advisory Committee (PAC) of the "iThemba Labs", Cape Town, South Africa
2021-present Head of the INFN-LNS Research Division

Referee for Journals:

Nature
Physical Review Letters
Physics Letters B
Physical Review C
European Physical Journal A
Journal of Physics G: Nuclear and Particle Physics
European Physics Letters
Frontiers in Physics
AIP, EPJ Web of Conferences, Journal of Physics: Conference Series

Member of Editorial Boards:

2018-2020 Heliyon, Elsevier
2018-present Frontiers in Physics
2020-present European Physical Journal A (Associate Editor)
2021-present Physical Review C
2022-present Few-Body Systems

Research Grants and Prizes

- P.I. of an AIM-CINECA project approved within the Italian PON Research and Innovation 2014 - 2020. The project provides the funding to hire a senior-type fixed-term researcher contract (197.857,80 €). (2019-present)
- European project ChETEC-INFRA funded by the EU under H2020-INFRAIA-2018-2020 (total funding 5 M€). Coordinator of the working group on “Complementarities and Comparisons Towards Standards: the Big Three for Evolved Stars”. (2020-present) (2020-present)
- "Giovan Pietro Grimaldi 2019" Prize, granted by the Grimaldi Foundation in collaboration with the Gioenia Academy for the best work in Physics carried out in the five-year period 2014-2018 in one of the Sicilian Universities or in public research centers operating in Sicily. The reference paper is “An increase in the $^{12}\text{C}+^{12}\text{C}$ fusion rate from resonances at astrophysical energies”, Nature, 557, (2018) 687, DOI: 10.1038 / s41586-018-0149-4
- Ulixes Prize, Person of the Year 2020 – Città dei Mosaici

Activity for Conferences and Workshops

- 2003-2007 Member of the Local Organizing Committee of the second, third and fourth editions of the "European Summer School On Experimental Nuclear Astrophysics"
- 2007 Editor of the proceedings of the Third European Summer School on Experimental Nuclear Astrophysics, EDP Sciences, 2007
- 2012 Member of the Local Organizing Committee of the international workshop ECOS 2012: Advances and Challenges in Nuclear Physics with High Intensity Stable Beams
- 2012-present Member of the International Advisory Committee of the Cluster conferences
- 2014 Convener for the Nuclear astrophysics at the ECT* Workshop on Future Directions
- 2017 Member of the Local Organizing Committee of the international conference “Nuclear Physics in Astrophysics VIII”
- 2018 Member of the Program Committee of the 15th International Symposium on Nuclei in the Cosmos
- 2019 Convener for the Nuclear Astrophysics Sessions of the INPC2019, Glasgow, Scotland
- 2020 Convener for the IReNA FA1 workshop on underground physics, Notre Dame, Indiana
- 2020 Chairman of the Workshop “Key Reactions in Nuclear Astrophysics”, ECT* Trento
- 2021 Member of the International Advisory Committee of the ANPC21 conference
- 2021 Member of the Steering Committee of the ANPS21
- 2022 Convener for the Nuclear Astrophysics Sessions of the INPC2022, Cape Town, South Africa
- 2022 Member of the Local Organizing Committee of the IReNA and ChETEC-INFRA workshop, Rome, Italy
- 2022 Chairman of the Workshop “Key Reactions in Nuclear Astrophysics”, ECT* Trento

Teaching Activity

2004-2008 Physics, Faculty of Architecture

2007-present Physics 1 and 2 –Mechanics, Thermodynamics, Electromagnetism and Optics,
Faculty of Engineering

2011-2012 Environmental Electromagnetism, Faculty of Engineering

Research activity

My research activity is focused on topics related to Nuclear Astrophysics, in particular on the application of indirect techniques to measure the bare nucleus astrophysical $S(E)$ -factor down to zero energy. I am mainly involved in the development and application of the Trojan Horse Method (THM), which has proven to be very powerful for studying two-body reactions between charged particles. The THM has been successfully applied to several reactions of astrophysical interest involved in different scenarios in the primordial and stellar nucleosynthesis, such as d-burning, Li and light element (Be and B) depletion, the role of ^{19}F abundance in the chemical evolution of AGB stars (see short list of Publications as reference). I have been involved in more than seventy experiments, fifteen of those as spokesperson. In particular, I have been spokesperson and corresponding author of an important research on C-burning in massive stars that has been published in Nature. Recently, I have also been involved in experimental activities for in-plasma studies of nuclear cross sections and stellar opacity. The research activity is documented by more than 250 publications in international Journals, and by more than 70 invited talks/seminars to Conferences, Workshops and Schools.

List of invited talks/Seminars in the last years

- 2021-Workshop on Cluster Phenomena in Knockout and Astrophysical Reactions, Japan (online), October 14-15 2021
- 2021- ChETEC Meeting, Lisbon, September 7-10, 2021
- 2021-Carpathian Summer School of Physics, Sinaia August 19-27, 2021
- 2021-National Nuclear Physics Summer School, UNAM, Mexico, June 21-25, 2021
- 2021-Joint APP, HEPP and NP online Conference, Institute of Physics, April 12-15, 2021
- 2021- NUSTAR Annual Meeting, February 24-25 2021
- 2021- SNAQs virtual nuclear astrophysics schools, February 17, 2021
- 2020- 8th International conference on heavy-ion collisions at near barrier energies (FUSION20), Shizuoka, Japan, November 15-20 (postponed due to Covid19 emergency)
- 2020-international workshop on "Critical Stability" at the ICTP South American Institute for Fundamental Research, Sao Paulo, Brazil, October 12-16 (postponed due to Covid19 emergency)
- 2020- 17th International Symposium on Capture Gamma-Ray Spectroscopy and Related Topics (CGS17), Grenoble, August 31 – September 04 (postponed due to Covid19 emergency)
- 2020- IReNA FA1 workshop on underground physics, Notre Dame, Indiana July 25-29 (postponed due to Covid19 emergency)
- 2020- Carpathian Summer School of Physics 2020, Sinaia, Romania, June 28 – July 11 (postponed due to Covid19 emergency)
- 2020- Institute of Physics annual conference, Edinburgh, Scotland, April 6-9 (postponed due to Covid19 emergency)
- 2020- Russbach school on nuclear astrophysics 2020, Russbach, Austria, March 15-21 (postponed due to Covid19 emergency)
- 2020- Indirect Methods to constrain the $^{12}\text{C}+^{12}\text{C}$ fusion at astrophysical energies, Webinar “Angel Dacar”, Departamento de Fisica Nuclear y Aplicaciones de la Radiacion otorga el presente, May 19th.

- 2019-“The $12\text{C}+12\text{C}$ burning explored with the THM”, Decimo incontro nazionale dei gruppi italiani di astrofisica nucleare teorica e sperimentale (GIANTS-X), Genova, Italy, October 23-25
- 2019-“Indirect Methods Constraining Nuclear Capture – the Trojan Horse Method”, Nuclear Physics in Astrophysics IX, Frankfurt, Germany, September 15-20, 2019
- 2019- “Indirect Experimental Methods and the $12\text{C}+12\text{C}$ Fusion”, African Nuclear Physics Conference, Kruger Park, South Africa, July, 1-5, 2019
- 2019- “Nuclear Astrophysics with the Trojan Horse Method” Cluster of Excellence PRISMA, Johannes Gutenberg Universität, Mainz, June, 11-12 2019
- 2019-“Nuclear Physics in Stellar Lifestyles with the Trojan Horse Method”, Nuclear Structure and Dynamics 2019, Venice, Italy, May 13-17 2019
- 2019-“Nuclear Astrophysics with Indirect Methods”, Joint LIA COLL---AGAIN, COPIGAL and POLITA workshop, Warsaw, Poland, March 5-7 2019
- 2019-“Indirect Methods in Nuclear Astrophysics”, 57th International Winter Meeting on Nuclear Physics, Bormio, Italy, January 21-25, 2019
- 2018-“Resonant C-burning at astrophysical energies”, NN2018-13th International Conference on Nucleus-Nucleus Collisions, Saitama, Japan, December 4-8, 2018
- 2018-”Resonant carbon burning to reshape star evolution”, Workshop on Indirect Methods in Nuclear Astrophysics, Indirect Methods in Nuclear Astrophysics, ECT*, Trento, Italy, November 5-9, 2018
- 2018-“ Stellar carbon-burning via the Trojan Horse Method” The 6th International Conference on Collective Motion in Nuclei under Extreme Conditions (COMEX 6), Cape Town, South Africa, 29 October -2 November 2018
- 2018-“Uncovering carbon burning in stars”, 2018 European Nuclear Physics Conference, Bologna, Italy, September 2-7, 2018
- 2018 – “The resonant behaviour of the $12\text{C}+12\text{C}$ fusion cross section at astrophysical energies”, 15th International Symposium on “Nuclei in the Cosmos”, Laboratori Nazionali del Gran Sasso, Assergi, Italy, June 24-29, 2018
- 2018 - "State-of-the-art and recent $12\text{C}+12\text{C}$ results" 4th international workshop on "State of the Art in Nuclear Cluster Physics" (SOTANCP4), Galveston, Texas, May 13-18, 2018
- 2017 – “Resonant reactions in nuclear astrophysics with the Trojan Horse method”, IEA Workshop: "The Nucleus-Nucleus Interaction and Reactions with Exotic Nuclei (Sao Paulo, Brasil, April 10 – 13, 2017)
- 2017 – “Triple alpha resonances in the $6\text{Li}+6\text{Li}$ interaction at low energy and possible link to the Efimov trimers”, Workshop on Open Quantum Systems: From atomic nuclei to ultracold atoms and quantum optics, European Center for Theoretical Studies (ECT*), Trento, Italy 10-14 July 2017
- 2017 – “The Trojan Horse Method in nuclear astrophysics”, The 9th European Summer School on Experimental Nuclear Astrophysics St. Tecla (Catania), 17-24 September 2017
- 2017 – “Bare nucleus cross-sections for nuclear astrophysics studies with the THM”, International Symposium on Physics of Unstable Nuclei, 24-30 September, Halong City, Vietnam 2017
- 2017 – Efimov physics in nuclei: the case of the $6\text{Li}+6\text{Li}$ interaction at low energy, Conference on Critically Stable Quantum Systems (Dresden, Italy 16-20 October 2017);
- 2016 – “Trojan horse Method for resonant reactions in nuclear astrophysics including recent results”, ENSAR2-NUSPRASEN Workshop, (ISOLDE - CERN, Geneva, Switzerland, December, 6, 2016)
- 2016 – “Strutture a cluster in reazioni tra nuclei leggeri”, Terzo Incontro Nazionale di Fisica Nucleare INFN2016, (Frascati, Italy, November, 14-16, 2016)
- 2016 – “Nuclear Astrophysics”, Tastes of Nuclear Physics School, Stellenbosch University, (Stellenbosch, South Africa, November, 1-3, 2016)
- 2016 – “Recent results for nuclear astrophysics with the Trojan horse Method applied to stable and radioactive nuclei”, Workshop on Three-body Systems in Reactions with rare isotopes, ECT*, (Trento, Italy, 3-8 October 2016)

- 2016 – “Clusterization of Light Nuclei and the Trojan Horse Method”, 11th International Conference on Clustering Aspects of Nuclear Structure and Dynamics (23-27 May 2016, Naples)
- 2016 – “The $^{12}\text{C}(^{12}\text{C},\alpha)^{20}\text{Ne}$ and $^{12}\text{C}(^{12}\text{C},p)^{23}\text{N}$ reactions at the Gamow peak”, Carpathian Summer School of Physics 2016, (26 June – 9 July, Sinaia, Romania)
- 2015 – “Future challenges in nuclear astrophysics with high intensity stable ion beams ”ECOS-LINCE Workshop , (Huelva, Spain, July 8-10, 2015)
- 2015 – “Carbon-burning at sub-barrier energies” Humboldt Kolleg ”Interfacing structure and reaction dynamics in the synthesis of heavy nuclei”, (ECT, Trento, September 1-4 2015)
- 2015 – “The $^{12}\text{C}(^{12}\text{C},\alpha)^{20}\text{Ne}$ and $^{12}\text{C}(^{12}\text{C},p)^{23}\text{Na}$ reactions at the Gamow peak via the Trojan Horse Method”, 12th International Conference on Nucleus Nucleus Collisions (Catania, Italy, June 21-26, 2015)
- 2014 - “Nuclear Astrophysics and Nuclear Reactions”, Workshop on "Future Directions in the Physics of Nuclei at Low Energies", (ECT, Trento, May 21-23, 2014)
- 2014 - “Unscreened cross-sections for nuclear astrophysics via the Trojan Horse Method”, 3rd international workshop on "State of the Art in Nuclear Cluster Physics" (SOTANCP3), (Yokohama, Japan, May 26-30, 2014)
- 2013 - “Direct Nuclear Reactions and Astrophysics”, ECOS-LINCE Workshop: Perspectives Of High Intensity Beams At The Lince Facility In Spain, (Huelva, Spain, October 30-31, 2013)
- 2013- “The Trojan Horse Method for Nuclear Astrophysics: Recent Results for Direct Reactions” VII European Summer School on Experimental Nuclear Astrophysics(S.Tecla,Italy,15-27 September 2013)
- 2013 - ”From Nuclei to Stars with a Trojan Horse” XXXIII Mazurian Lakes Conference on Physics -Frontiers in Nuclear Physics (Piaski, Poland, September 1-7, 2013)
- 2013-“Nuclear Astrophysics with the Trojan Horse Method”, Nuclear Physics in Astrophysics VI, (Lisbon, Portugal May 19-24 2013)
- 2013- “The Trojan Horse Method in Nuclear Astrophysics”, 2nd Workshop on the physics at the TANDEM-ALTO facility, (Orsay, Paris, France, May 13-15 2013)
- 2013 - " $^2\text{H}(d,p)^3\text{H}$ and $^2\text{H}(d,n)^3\text{He}$ reaction rates at astrophysical energies", International Workshop XLI on Gross Properties of Nuclei and Nuclear Excitations, (Hirschegg, Kleinwalsertal, Austria, gennaio 26 - February 1, 2013);

Bibliometric indicators:

Publications: >500, from WoS (Oct 2021): articles 280, h-index 41, citations 3858

Scientific Dissemination Activity

2002-present Plenary talks to students and general public during the “Settimana della Cultura Scientifica” organized every year at the INFN-Laboratori Nazionali del Sud

2018 - public talk within the SHARPER activities during the “Notte dei Ricercatori”

2018 dissemination paper on Stars and C-burning published in GIANTS – Notiziario di Astrofisica Nucleare – n.4 Dec-. 2018

List of recent Publications

- Pizzone, R. G.; Spitaleri, C.; Bertulani, C.A., Mukhamedzhanov, AM; Blokhintsev, L; La Cognata, M; Lamia, L; Rinollo, A; Sparta, R; **Tumino, A**; *Updated evidence of the Trojan horse particle invariance for the $^2\text{H}(d,p)^3\text{H}$ reaction*, **Physical Review C**, 87 (2013) 025805.
- **Tumino, A.**; Spitaleri, C.; Cherubini, S, Gulino, M; La Cognata, M; Lamia, L; Pizzone, RG; Puglia, SMR; Rapisarda, GG; Romano, S; Sergi, ML; Sparta, R, *New Advances in the Trojan Horse Method as an Indirect Approach to Nuclear Astrophysics*, **Few-Body Syst.**, 54 (2013) 745.

- Lamia, L.; Spitaleri, C.; Pizzone, R.G., Tognelli, E; **Tumino, A**; Degl'Innocenti, S; Moroni, PGP; La Cognata, M; Pappalardo; Sergi, ML, *An Updated ${}^6\text{Li}(p,\alpha){}^3\text{He}$ He Reaction Rate at Astrophysical Energies with the Trojan Horse Method*, **Astrophysical Journal** 768 (2013) 65.
- **A. Tumino**, C. Spitaleri, C. Bertulani, A. M. Mukhamedzhanov, *Nuclear Astrophysics from View Point of Few-Body Problems*, **Few-Body Systems** 54 (2013) 869, DOI 10.1007/s00601-013-0690-5.
- **A. Tumino**, R. Spartà, C. Spitaleri, A.M. Mukhamedzhanov, S. Typel, R.G. Pizzone, E. Tognelli, S. Degl'Innocenti, V. Burjan, V. Kroha, Z. Hons, M. La Cognata, L. Lamia, J. Mrazek, S. Piskor, P.G. Prada Moroni, G.G. Rapisarda, S. Romano, M.L. Sergi, R. Sparta, *New determination of the ${}^2\text{H}(d,p){}^3\text{H}$ and ${}^2\text{H}(d,n){}^3\text{He}$ reaction rates at astrophysical energies*, **Astrophysical Journal** 785 (2014) 96.
- R.G. Pizzone, R. Spartà, C.A. Bertulani, C. Spitaleri, M. La Cognata, J. Lalmansingh, L. Lamia, AM Mukhamedzhanov, and **A. Tumino**, *Big Bang Nucleosynthesis revisited via Trojan Horse Method Measurements*, **Astrophysical Journal** 786 (2014) 112.
- C. Spitaleri, **A. Tumino**, M. Lattuada, R.G. Pizzone, S. Tudisco, Dj. Miljanic, S. Tudisco and N. Soic, *Quasifree mechanism in the ${}^6\text{Li} + {}^6\text{Li} \rightarrow 3\alpha$ reaction at low energy*, **Physical Review C**, 91 (2015) 024612.
- I. Lombardo, D. Dell'Aquila, A. Di Leva, I. Indelicato, M. La Cognata, M. La Commara, A. Ordine, V. Rigato, M. Romoli, E. Rosato, G. Spadaccini, C. Spitaleri, **A. Tumino**, M. Vigilante, **Physics Letters B**, 748 (2015) 178.
- **A. Tumino**, A. Bonasera, G. Giuliani, M. Lattuada, M. Milin, R.G. Pizzone, C. Spitaleri, S. Tudisco, *Triple α resonances in the ${}^6\text{Li}+{}^6\text{Li} \rightarrow 3\alpha$ reaction at low energy*, **Phys. Lett. B** 750 (2015)59.
- Caciolli, R. Depalo, C. Broggin, M. La Cognata, L. Lamia, R. Menegazzo, L. Mou, SMR Puglia, V. Rigato, S. Romano, C. Rossi Alvarez, ML Sergi, C. Spitaleri, **A Tumino**, *A new study of ${}^{10}\text{B}(p,\alpha){}^7\text{Be}$ reaction at low energies*, **EpJ A**, 52 (2016) .
- R.G. Pizzone, G. D'Agata, M. La Cognata, I. Indelicato, C. Spitaleri, S. Blagus, S. Cherubini, P. Figuera, L. Grassi, G.L. Guardo, M. Gulino, S. Hayakawa, R. Kshetri, L. Lamia, M. Lattuada, T. Mijatovic, M. Milin, D. Miljanic, D.L. Preolec, G.G. Rapisarda, S. Romano, M.L. Sergi, N. Skukan, N. Soic, V. Tokic, **A. Tumino** and M. Uroic, *First Measurement of the ${}^{19}\text{F}(\alpha, p){}^{22}\text{Ne}$ Reaction at Energies of Astrophysical Relevance*, **Astrophysical Journal** 836 (2017) 57.
- C. Spitaleri, S.M.R. Puglia, M. La Cognata, L. Lamia, S. Cherubini, A. Cvetinovic, G. D'Agata, M. Gulino, G. L. Guardo, I. Indelicato, R. G. Pizzone, G. G. Rapisarda, S. Romano, M.L. Sergi, R. Spartà, S. Tudisco, **A. Tumino**, M. Gimenez Del Santo, N. Carlin, M. G. Munhoz, F.A. Souza, A. Szanto de Toledo, A. Mukhamedzhanov, C. Broggin, A. Caciolli, R. Depalo, R. Menegazzo, V. Rigato, I. Lombardo and D. Dell'Aquila, *Measurement of the ${}^{10}\text{B}(p,\alpha){}^7\text{Be}$ cross section from 5 keV to 1.5 MeV in a single experiment using the Trojan horse method*, **Physical Review C**, 95 (2017) 035801.
- Chengbo Li, Qungang Wen, **A. Tumino**, Yuanyong Fu, Jing Zhou, Shuhua Zhou, Qiuying Meng, C. Spitaleri, R. G. Pizzone, and L. Lamia, *Beam-energy dependence and updated test of the*

Trojan-horse nucleus invariance via a measurement of the $^2\text{H}(d,p)^3\text{H}$ reaction at low energies, **Physical Review C**, 95 (2017) 035803.

- M. La Cognata, A. Anzalone, D. Balabanski, S. Chesnevskaia, V. Crucillà, D.M. Filipescu, G.L. Guardo, M. Gulino, D. Lattuada, C. Matei, R.G. Pizzone, S. Romano, C. Spitaleri, A. Taffara, O. Tesileanu, **A. Tumino** and Y. Xu, *Gamma ray beams for Nuclear Astrophysics: first results of tests and simulations of the ELISSA array*, **Journal of Instrumentation**, 12 (2017) C03079
- I. Indelicato, M. La Cognata, C. Spitaleri, V. Burjan, S. Cherubini, M. Gulino, S. Hayakawa, Z. Hons, V. Kroha, L. Lamia, M. Mazzocco, J. Mrazek, R.G. Pizzone, S. Romano, E. Strano, D. Torresi, **A. Tumino**, *New Improved Indirect Measurement of the $^{19}\text{F}(p,\alpha)^{16}\text{O}$ Reaction at Energies of Astrophysical Relevance*, **Astrophysical Journal** 845 (2017) 19
- Cvetinović, A., Spitaleri, C., Spartà, R., Rapisarda, G. G., Puglia, S. M. R., La Cognata, M., Cherubini, S., Guardo, G. L., Gulino, M., Lamia, L., Pizzone, R. G., Romano, S., Sergi, M. L., **Tumino, A.** (2018). Trojan horse measurement of the $\text{B}10(p,\alpha)\text{Be}7$ cross section in the energy range from 3 keV to 2.2 MeV. **Physical Review C**, vol. 97, ISSN: 2469-9985, doi: 10.1103/PhysRevC.97.065801
- **Tumino, A.**, Bonasera, A, Giuliani, G., Lattuada, M., Milin, M., Pizzone, R. G., Spitaleri, C., Tudisco, S. (2018). Triple alpha Resonances and Possible Link to the Efimov Trimers. **Few-Body Systems**, vol. 59, ISSN: 0177-7963, doi: 10.1007/s00601-018-1374-y
- D'Agata, G., Pizzone, R. G., Cognata, M. La, Indelicato, I., Spitaleri, C., Palmerini, S., Trippella, O., Vescovi, D., Blagus, S., Cherubini, S., Figuera, P., Grassi, L., Guardo, G. L., Gulino, M., Hayakawa, S., Kshetri, R., Lamia, L., Lattuada, M., Mijatovic`, T., Milin, M., Miljanic`, Đ., Prepolec, L., Rapisarda, G. G., Romano, S., Sergi, M. L., Skukan, N., Soic`, N., Tokic`, V., **Tumino, A.**, Uroic`, M. (2018). The $^{19}\text{F}(\alpha, p)^{22}\text{Ne}$ Reaction at Energies of Astrophysical Relevance by Means of the Trojan Horse Method and Its Implications in AGB Stars. **The Astrophysical Journal**, vol. 860, ISSN: 1538-4357, doi: 10.3847/1538-4357/aac207
- **Tumino, A.**, Spitaleri, C, La Cognata, M, Cherubini, S, Guardo, G L, Gulino, M, Hayakawa, S, Indelicato, I, Lamia, L, Petrascu, H, Pizzone, R G, Puglia, S M R, Rapisarda, G G, Romano, S, Sergi, M L, Spartà, R, Trache, L (2018). An increase in the $^{12}\text{C} + ^{12}\text{C}$ fusion rate from resonances at astrophysical energies. **Nature**, vol. 557, p. 687, DOI: 10.1038/s41586-018-0149-4
- H. Y. Lan, Y. Xu, W. Luo, D. L. Balabanski, S. Goriely, M. La Cognata, C. Matei, A. Anzalone, S. Chesnevskaia, G. L. Guardo, D. Lattuada, R. G. Pizzone, S. Romano, C. Spitaleri, A. Taffara, **A. Tumino**, and Z. C. Zhu (2018). Determination of the photodisintegration reaction rates involving charged particles: Systematic calculations and proposed measurements based on the facility for Extreme Light Infrastructure–Nuclear Physics. **Phys. Rev. C** 98, 054601.
- G. G. Rapisarda, C. Spitaleri, A. Cvetinović, R. Spartà, S. Cherubini, G.L. Guardo, M. Gulino, M. La Cognata, L. Lamia, R.G. Pizzone, S. Romano, M.L. Sergi, **A. Tumino**. (2018) Study of the $^{10}\text{B}(p,\alpha_1)^7\text{Be}$ reaction by means of the Trojan Horse Method, **Eur. Phys. Journ. A** 54: 189.
- M. La Cognata, M. Fisichella, A. Pietro Di, P. Figuera, V. Z. Goldberg, S. Cherubini, J. P. Fernández Garcia, M. Gulino, L. Lamia, D. Lattuada, M. Lattuada, R. G. Pizzone, G. G. Rapisarda, S. Romano, R. Spartà, C. Spitaleri, D. Torresi, **A. Tumino**, and M. Zadro (2019). Observation of $^{15}\text{N}+\alpha$ resonant structures in ^{19}F using the thick target in inverse kinematics scattering method, **Phys. Rev. C** 99, 034301.

- C. Spitaleri, M. La Cognata, L. Lamia, R.G. Pizzone, A. Tumino, (2019) Astrophysical Studies with the Trojan Horse Method, **Eur. Phys. Journ. A** 55 : 161
- L. Lamia, M. Mazzocco, R.G. Pizzone , A. Tumino, Y. Yamaguchi, G.L. Zhang, (2019) Cross-section Measurement of the Cosmologically Relevant Be-7(n, alpha)He-4 Reaction over a Broad Energy Range in a Single Experiment, **The Astrophysical Journal**, vol. 879, DOI: 10.3847/1538-4357/ab2234
- W. Korten, A. Atac, D. Beaumel, A. Tumino, J.J. Valiente Dobon, O. Wieland, K. Wimmer, M. Zielinda, (2020) Physics opportunities with the Advanced Gamma Tracking Array: AGATA, **Eur. Phys. Journ. A** 56: 5
- R. G. Pizzone, C. Spampinato, R. Spartà, A. Tumino et al., (2020) Indirect measurement of the He-3(n,p)H-3 reaction cross section at Big Bang energies **Eur. Phys. Journ. A** 56: 199
- D.K. Nauruzbayev, A.K. Nurmukhanbetova, V.Z. Goldberg, A. Tumino, A. Serikov, E.M. Gazeeva, (2020) Strong Resonances at High Excitation Energy in O17+alpha Resonance Scattering, **Physics of Atomic Nuclei**, 83, 520

CURRICULUM VITAE

Luigi Giuseppe Celona

PERSONAL SUMMARY

L.G. Celona received the degree in Electronic Engineering at the University of Catania, in 1995 and he joined the Istituto Nazionale di Fisica Nucleare in 1996, at the Laboratori Nazionali del Sud (INFN-LNS), becoming Technological Engineer (“Tecnologo”) in 1998, Principal Technological Engineer (Primo Tecnologo) in 2006 and Technological Research Director in 2019.

His main field of activity covers all the aspects of the production of singly and highly charged beams together with their acceleration to increase the performances of Particles Accelerators for Nuclear and Applied Physics.

Experienced in all the design stages of an ion source: from mechanical design and manufacturing through the installation and final commissioning, he is also active in research and development, proposing different innovative concepts concerning the role of microwaves in the development of ECR and microwave ion sources. He is actively working on the construction and development of many different ion sources, carrying out various experiments at the major facilities worldwide (GSI, CEA, MSU, LPSC, JYFL, LBNL, IMP, etc), interacting also on several technical issues with their relative experts and sometime getting involved in finding a solution.

Actually, he is the Head of the INFN-LNS Accelerator Division, a member of the Conseil Scientifique et Technique du Département (CSTD) des Accélérateurs, de Cryogénie et de Magnétisme (DACM) du CEA and he recently finished his mandate of the INFN Machine Advisory Committee with the aim to evaluate the existing and the new proposals, to develop innovative technologies in the accelerator physics, to address the participation to European projects devoted to the realization of new big research infrastructure and the relative impact on financial and human resources needed. He was member of the steering committee of the SPES project and, in the European framework, he was a referee committee member of ARES and EMILIE projects to coordinate the R&D activities on ECR ion sources of the major European physics labs.

He was the technical and scientific responsible of a joint-venture between INFN-LNS and some SMEs to design, realize and test a new hybrid ion source for Hadrontherapy named AISHa; two ion sources have been manufactured and successfully commissioned, others are under discussion. He worked also for the actual CNAO ECR sources with technical innovations to reach the requests set by the facility.

He was the Leader of the design, manufacturing and commissioning of the high intensity proton sources along with the low energy beam transfer line for the European Spallation Source (ESS). A deep effort has been needed to cope the stringent requests in terms of high beam reliability, low emittance, fast beam pulse rise/fall times and the wide current tuning range. The outstanding commissioning results fully comply the requirements given. The first source has been successfully installed in its final position at ESS site at the beginning of 2018 as a first part of ESS linac.

He also designed and built other types of ion and plasma sources for high efficiency ionization of the reaction products originating from an ISOL target and for intense monocharged production of light ions.

During the period 2004-2007 he focused his efforts on the EXCYT radioactive beam facility, coordinating the installation, the commissioning and permitting to deliver the ^8Li beam for the first experiments. He also worked on the development of the K-800 Superconducting Cyclotron bunching system contributing to the optimization of the cyclotron in the years 1995-1998 and to the axial injection beamline.

During the years, in the framework of the INFN 5th National Commission he proposed several experiments acting also as National or Local Responsible, actually he is the national responsible of the IONS experiment.

The great continuity and quality of the results obtained on several fronts at the same time is evidenced by the number of oral and invited talks presented to international conferences.

He is a IAC member of the HIAT and ECRIS conferences, several times served as SPC member of ICIS conference and he was the chair of ECRIS 2018 and Co- Chair of ICIS 2011.

Possessing a good team spirit, he developed a team leadership style based on result oriented and effective approach.

Research Topics

Microwave-plasma interaction- Plasma Based Ion sources- Electron Cyclotron Resonance Ion Sources- Plasma and ion beams diagnostics methods- Multidisciplinary applications of plasmas- RF based plasma diagnostics methods, plasma immersed probes (Langmuir Probe) and plasma-emitted radiation diagnostics (OES, X ray detectors, interferometers)- Simulation and modelling of plasma dynamics (heating, confinement)- Production of intense beams of monocharged ions- Beam transport and acceleration.

Professional record

- March 2019 – today **Permanent staff at INFN Laboratori Nazionali del Sud, Catania.**
I level MSc. Technological Research Director
“Dirigente Tecnologo” winner of competitive examination 19816/2018.
- Jan. 2006 – Feb. 2019 **Permanent staff at INFN Laboratori Nazionali del Sud, Catania.**
II level Principal MSc. Technological Engineer
“Primo Tecnologo” winner of competitive examination 10668/2004.
- Feb 2001-Dec. 2005 **Permanent staff at INFN Laboratori Nazionali del Sud, Catania.**
III level MSc. Technological Engineer
“Tecnologo” winner of competitive examination 7708/99.
- Oct. 1998-Oct. 2001 **Temporary staff at INFN Laboratori Nazionali del Sud, Catania.**
III level MSc. Technological Engineer
- Oct. 1996-Oct. 1998 **Fellowship at INFN Laboratori Nazionali del Sud, Catania.**
Project: “ Study of the coupling between microwave generators and ion sources”.
- Oct. 1995-Feb. 1996 **ANTECH S.p.A. - Catania**
Professional agreement for the study, realization and installation of the transmission filters and waveguide branching to be installed at satellite TV AB Television (France).

Education

- April 1995 **University of Catania, Italy**
Master degree in Electronic Engineering. (5 yrs.)
 Design and implementation of a Low Energy buncher for the K-800 superconducting cyclotron (*carried out in the INFN-LNS Accelerator Division*).

Qualifications

- March 2018- March 2024 **National Scientific Qualification to function as Associate Professor in Italian Universities** (Italian Ministry of Education, universities and research – MIUR) - Sector 09/F1– “Campi elettromagnetici”
- June 1995 Officially recognized by the Italian government as **Professional Engineer** after successfully completing the State examination.

- Spoken languages** *Italian:* Mother Tongue *English:* Fluent writing & speaking
 French: Good writing & speaking, *German:* Elementary notions

Coordination and Management

- April 2021-today* **Head of INFN-LNS Accelerator Division.**
- January 2021-today* **National responsible of the IONS experiment within the 5th INFN commission (Technological, interdisciplinary and accelerators research).**
The IONS experiment proposes a research and development program aimed at improving the performance of positive ion sources for accelerators, through knowledge and control of plasma parameters and the relative correlation with beam parameters. (Budget: ~300 k€)
- January 2020- today* **Local responsible of the IONS experiment within the 3rd INFN commission (Nuclear Physics).**
The PANDORA experiment aims to use a magnetic trap capable of confining plasmas at high temperature (up to 10^8 K) and density of the order of 10^{13} cm⁻³, containing multi-ionized radioactive isotopes in order to study their β decay in astrophysical conditions (for example, for the elements involved in the "s" process of stellar nucleosynthesis). The final goal is to measure the variation of the average lifetimes of isotopes subject to β decay, theoretically predicted and experimentally observed only in a small number of isotopes under conditions of maximum ionization. (Budget 3 M€)
- June 2018-today* **Member of the Conseil Scientifique et Technique du Département (CSTD) des Accélérateurs, de Cryogénie et de Magnétisme (DACM) du CEA.**
- June 2017-April 2020* **Member of the INFN Machine Advisory committee.**
Evaluation of the existing and new proposals to develop innovative technologies in the accelerator physics; address the participation to European projects devoted to the realization of new big research infrastructure and the relative impact on financial and human resources needed.
- Jan. 2013-today* **AISHa project team leader.**
*Design, construction and commissioning of a high performance ECR ion source for Hadrontherapy.
 Supported by the Regional Government of Sicily and funded within the framework of the Sicilian Government program named PO FESR 2007-2013 (Budget: ~5 M€).*
- Jan. 2011-Oct.2021* **Leader of the Work Unit regarding the high intensity ESS proton sources and its LEBT.**
*Design, construction and commissioning of two high intensity proton sources for the European Spallation Source along with their Low Energy Beam Transfer Line.
 Supported by the MIUR (Budget: ~5.1 M€).*
- 2016- 2019* **DEMETRA experiment**
Study and development of high gradient dielectric and metallic RF accelerating structures. Supported by the 5th National Commission of INFN (Budget: 303 k€).
- 2013- 2016* **Leader of the Work Package 8 inside the RDH experiment**
*Design and development of new components of accelerators for Hadrontherapy.
 Supported by the 5th National Commission of INFN (Budget: 83 k€).*
- 2012-2013* **National responsible of the UTOPIA experiment**

*Electromagnetic wave interaction with plasma and generation of plasma waves in compact size machines. (merged into WP8 of RDH a year after its opening).
Supported by the 5th National Commission of INFN (Budget: 66 k€).*

- 2012-2014 **Referee committee member of the ARES European collaboration**
*Coordination of the R&D activities on ECR ion sources (Task1: Plasma heating, Wave-plasma interaction) of the major European physics labs (GSI, INFN, KVI, JYFL, ATOMKI, IFIN-HH, IKF) participating to the European programme.
Final meeting: <http://indico.gsi.de/event/3261/>*
- 2012-2016 **Referee committee member of the EMILIE European collaboration**
Coordination of the R&D activities on ECR-based charge breeders of the major European physics labs (GANIL, INFN, LPSC, HIL, JYFL, CERN) to enhance the production of short lived isotopes.
- 2010-2013 **Member of the SPES referee committee**
Address the technical and financial issues related to the construction of the SPES radioactive nuclear beam facility at INFN-LNL.
- 2009-2011 **Responsible for INFN-LNS of the HELIOS experiment**
*Generation of hot electron layers in high density plasmas of ECR Ion Sources under different values of power and frequencies of the pumping electromagnetic wave.
Supported by the 5th National Commission of INFN (Budget: 210 k€).*
- 2005-2008 **Responsible for INFN-LNS of the INES experiment**
*Innovative methods of electromagnetic waves coupling to plasmas of ECR Ion Sources
Supported by the 5th National Commission of INFN (Budget: 160k€).*
- 2004-2007 **Technological and scientific coordination of the EXCYT facility**
Coordination of the final assembling, the commissioning and the first experiments of the EXCYT facility at INFN-LNS.
- 2002-2008 **Representative of the LNS Technological Research personnel for two terms**

Committee Memberships

- 2022 **Member of the International Advisory Committee of the 15th International Conference on Heavy Ion Accelerator Technology**
<https://indico.gsi.de/event/12135/page/1171-international-advisory-committee>
- 2021 **Member of the Scientific Advisory Committee of the International Conference on Ion Sources, September 2021**
<https://icis2021.triumf.ca/committees.html>
- 2020 **Member of the International Advisory Committee of the 24th International Workshop on ECR Ion Sources, September 2020**
<https://indico.frib.msu.edu/event/9/page/238-committees>
- 2019 **Member of the Scientific Advisory Committee of the 18th International Conference on Ion Sources, Lanzhou, September 2019**
<https://icis2019.impcas.ac.cn/event/1/>
- 2016 **Chairman of the 23rd International Workshop on ECR Ion Sources, Catania (Italy), September 2018** <http://ecris18.lns.infn.it/>
- 2011 **Co-chairman and SPC Member of the 14th International Conference on Ion Sources, Giardini Naxos (Italy), September 12th – 16th 2011**

Track record of the Technological Activities

Overview

L.G. Celona received the degree in Electronic Engineering at the University of Catania, in 1995 and he joined the Istituto Nazionale di Fisica Nucleare in 1996, at the Laboratori Nazionali del Sud (INFN-LNS), becoming Technological Engineer (“Tecnologo”) in 1998, Principal Technological Engineer (Primo Tecnologo) in 2006 and Technological Research Director in 2019.

Since April 2021 I was appointed with a 3-year mandate as Head of Accelerator Division in a critical time window where the LNS personal turn-over is overlapped with the completion of the POTLNS program whose goal is to refurbish and upgrade current LNS infrastructure by increasing the beam intensity at the exit of the cyclotron of about 2 orders of magnitude. This will also permit to increase the production of in-flight radioactive beams. The strengthening of the facility for the radioactive fragmentation beams production consists in the installation of a new fragment separator, called FRAISE, able to operate with a high intensity primary beam in an area where it is possible to install a shielding bunker (the new line will also be able to transport stable beams with high efficiency). In this framework the upgrading of the experimental apparatus for the NUMEN project is also planned.

Inside this scenario and to face such future challenges I pursued several actions to lead the entire division through this critical time: speaking with the different groups of the division with the main focus on the status of the high priority activities to be completed for the POTLNS programme, defining the work planning, the related budget and the resource allocations with the preparation of new organization chart, actually under examination at INFN board.

The technological and management activity over the years has been focused on the **design, construction and commissioning** of more **reliable and effective** Electron Cyclotron Resonance and Microwave Discharge Ion Sources to **increase** the Particles Accelerator performances.

High-performance plasma-based ion sources play a role of expanding importance, for feeding particle accelerators devoted to Nuclear Physics and Applied Research.

The driving idea of the entire activity has been to **refine the knowledge** on the fundamental **plasma physics** underlying the ion beam generation mechanism and consequently **improve all the related technological aspects**, this approach allowed significative performance steps forward in terms of overall performances.

Such goal has been achieved over the years working around all the components of an ion source: from the microwave injection to the beam formation, transport and its relative diagnostics.

Outstanding results have been obtained with this methodical approach especially pursuing the **studies about an optimal coupling between the electromagnetic waves and the generated plasmas**. The experiments start from the strong belief that an electromagnetic mode structure is enforced in the source plasma chamber even in presence of plasma. This approach allowed to **discover several interplays between the microscopical plasma parameters** – especially the electron energy distribution function and the structural

distribution of the plasma density – **and the beam quality**, namely the current, the average charge state, and the emittance.

The quality of the obtained results is testified by **several oral and invited talks** given in international conferences on such subject and **the acquired knowledge is now guiding the optimization of the existing sources** as well as the **design and construction of the future generation ECRIS**.

The innovative tests carried out over the years have constantly backed the activities of INFN-LNS ion sources group, which plays also a **worldwide leading role** in the **design, construction and characterization of ion injectors** for particles accelerators as demonstrated by the leadership's role covered in the ENSAR-ARES international collaboration (in the frame of the FP7/2007–2013) and in the European Spallation Source (ESS) project.

He is the Head of the INFN-LNS Accelerator Division and he is a member of the Conseil Scientifique et Technique du Département (CSTD) des Accélérateurs, de Cryogénie et de Magnétisme (DACM) du CEA and he just finished its mandate of the INFN Machine Advisory Committee as ion source expert with the aim to **evaluate the existing and the new proposals to develop innovative technologies in the accelerator physics**, to address the participation to European projects devoted to the realization of new big research infrastructure and the relative impact on financial and human resources needed. He was member of the steering committee of the SPES project and, in the European framework, he was a referee committee member of ARES and EMILIE projects to coordinate the R&D activities on ECR ion sources of the major European physics labs.

The technological research activity carried out and the experience gained has been recognized with the **leadership of the design, production and commissioning** of the high intense proton source and of the relative low energy transfer line (up to the RFQ) **for the ESS project**. A long phase of study and testing was necessary to define the design of the source because of the high-profile requirements in terms of reliability, current and emittance of the proton beam and times of rising and falling of the beam pulse.

The source resumes the experience gained in more than 20 years of work in this field and **represents the state of art of this kind of sources worldwide**: the **outstanding results of the commissioning** carried out at the LNS, followed by the **successful installation** and commissioning in the ESS accelerator tunnel have been an important milestone in the construction of this big infrastructure and it was reported in all the related accelerator conferences.

An important contribution to the development of **ECR sources for the CNAO hadrontherapy center has been given in the last decade**, in particular, the innovative solutions suggested allowed to satisfy the **requirements of reliability and intensity** of the beam produced which are **fundamental for such kind of application**. The need, in this specific field, to have a more performing source led to the definition of a new innovative and high performance source named AISHa designed to operate in a hospital environment with all the constraints related.

The realization of this source was financed in the line of intervention 4.1.1.1 of the **POR FESR Sicilia 2007-2013**, supporting the activities of experimental development, of industrial

research and, partially also of fundamental research with high degree of integration between SMEs and Research Institutions.

Currently he is the **Technical-Scientific Responsible of the Temporary Association of Companies** between INFN and the 3 participating SMEs. To date two sources have been built: one within the aforementioned POR and a second one funded under the IRPT project. The achieved results have raised up a lot of interest by the scientific community because it represents a **turnkey solution to get a compact and performant source that are of interest also in nuclear physics labs.**

Furthermore, the activities have given rise to several completely innovative sources in the framework of several projects, such as: **MIDAS2, TRIPS, VIS**, in which he independently carried out the conceptual design, defining all the characteristic parameters and coordinating the subsequent operative steps: the design of the equipment, the construction, the installation, tests and data acquisition, analysis and results synthesis.

In particular, the **MIDAS2** source was found to be very suitable for the **ionization of the reaction products produced from ISOL targets** and this solution was subsequently **adopted by several laboratories** (TRIUMF, GANIL, CERN).

The TRIPS project was **financed by the Ministry of University and Scientific Research, according to the law 95/95 for the technology transfer** and our work was carried out in collaboration with a consortium of companies (HITEC-SISTEC), demonstrating the possibility of an effective transfer of know-how.

The **VIS** source, born as an evolution of TRIPS, is extremely **versatile for high intensity production of light ions** (H, H₂, D, He, O). From 2013 to the end of 2014, it was operating at the BEST company (Vancouver, Canada) as intense H₂⁺ beam injector in a cyclotron used to study the central region of the accelerators to be implemented for the ISODAR and DAEΔALUS projects.

During the years 2004-2007 he also contributed significantly in the **realization of the EXCYT radioactive beam facility** focusing his daily efforts *coordinating* the installation, the commissioning of the entire facility and permitting to deliver the ⁸Li beam to the first experiments.

In this activity he continuously interacted with the staff of the technical division and the accelerator division of the LNS, supervising the work of the external companies employed, and organizing them in order to **allow the smooth running of the scientific program** of the LNS.

During the years, within the 5th National Commission as National or Local Responsible, he carried out a series of systematic study under several experiments with the aim to reveal the underlying physics, to optimize the related technologies and to analytically formalize the problem. In particular he is the national responsible of the **IONS** experiment, he was the **local responsible at LNS of INES and HELIOS** experiments and the **national responsible of the UTOPIA** experiment (merged into **WP8 of RDH** a year after its opening).

The experimental activity proceeded constantly side by side with the modelling through an analytical approach and with state of art electromagnetic simulators (HFSS, CST). Such tools, adequately supported by calculation resources permitted at the beginning to have the first

qualitative feedbacks on the wave-plasma interaction and on the ionization processes inside the plasma chamber, recently the *plasma "medium" has been successfully* taken into account implementing also the *self-consistency* procedures.

The results of this approach have shown a behavior of the source *strongly dependent also on small variations in frequency* (what he called "*frequency tuning effect*"), introducing to with the international community an innovative but disruptive and problematic concept.

These forecasts have been *confirmed by a series of measurements* made at GSI, where also investigated the output beam distribution has been investigated. In particular, by making frequency *variations of the order of MHz around the 14 GHz central frequency*, we found *variations in the emittance of the extracted beam*, accompanied also by a *variation in the intensity of the produced current*. Similar observations have been repeated in various laboratories confirming the reproducibility *of the phenomenon* described above and this has drawn the attention of the international community on the *importance of the coupling* between microwaves and ion sources.

The experimental validation of the *scaling laws up to 28 GHz* at INFN-LNS on the SERSE ion source represents a *breakthrough activity* that was carried out in the framework of a CERN-CEA-ISN-GSI-INFN collaboration, which aimed to produce medium-high and high-intensity ions for LHC. In the experiment he studied and realized the *coupling of the gyrotron of 28GHz-10 kW* with the SERSE source. It was the **first time** that a generator operating at such a **high frequency was coupled with an ECR source and the technological problems were brilliantly overcome** allowing to operate with a very low percentage of reflected power (in the order of a few%) obtaining current values and charge status never obtained previously. **Currently the existing 3rd generation sources such as VENUS (LBNL), SECRAL (IMP), SC-ECRIS (Riken), use the same coupling scheme developed and tested for the first time on SERSE.**

The results achieved have been a **milestone** and permitted to **start the design of last generation ECRIS**, the idea was object of several invited on coupling issues.

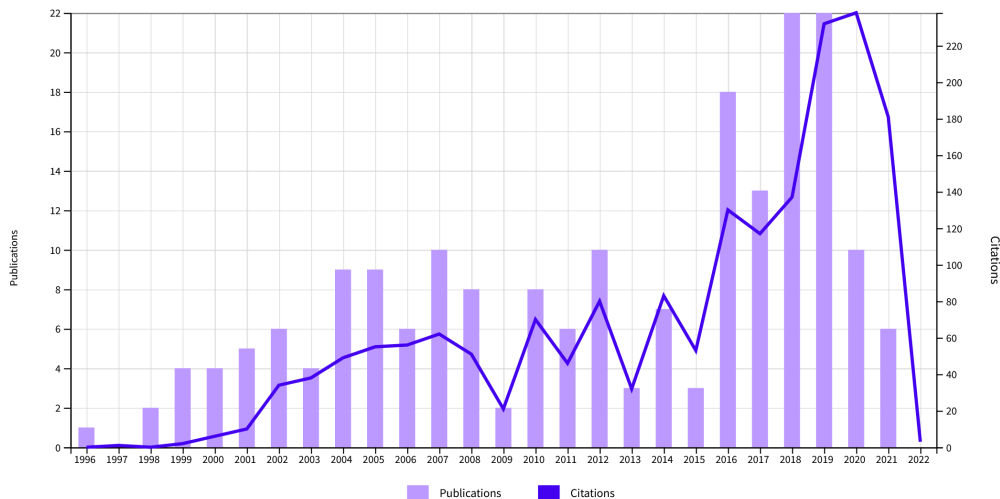
More recently, attention moved on the challenges for the coupling of 4th generation ECRIS (45 GHz). In particular, in the *optical approximation* other mechanism enter into the game and the microwave to plasma power deposition can be highly controlled.

Actually, the single-pass RF energy absorption efficiency at the Electron Cyclotron Resonance Layer is rather poor, and it is still difficult to drive energy deposition to specific parts of electron population. A "*microwave absorption optimization oriented*" design, based on the control of the electromagnetic radiation by a dedicated RF launcher, will permit a precise control of the **power deposition**. One of these launchers has been designed under my supervision and extensive test are planned for the first time in a compact ECR ion source.

The great continuity and quality of the results obtained on several fronts is testified by the number of oral and invited talks presented by him or co-workers in international conferences, by the large number of references to the works published and by several awards (Resmini and Geller prizes) given to doctorates working such topics under my supervision.

Publications

- **198 Papers indexed by ISI Web of Science (222 indexed by SCOPUS)**
- **H-index 20 according to ISI Web of Science (23 by SCOPUS, 30 by Scholar)**
- **Citations:1787 according to ISI Web of Science (1686 SCOPUS, 2779 by Scholar)**



10 papers

- 1) **L. Celona**, G. Ciavola, S. Gammino, *Study of microwave coupling in ECR ion sources and microwave ion sources*, Rev. Sci. Instr. 69(2), 1998, 1113-1115
- 2) S. Gammino, G. Ciavola, **L. Celona**, D. Hitz, A. Girard, G. Melin *Operation of the SERSE superconducting electron cyclotron resonance ion source at 28 GHz*, Rev. Sci. Instr., 72 (11), (2001), 4090-4097
- 3) **L. Celona**, G. Ciavola, S. Gammino, L. Andò, M. Presti, X. Guo, R. Gobin, R. Ferdinand, *Status of the TRIPS source and emittance measurements* Rev. Sci. Instr. 75 (5), (2004) 1423-1426
- 4) G. Cuttone, **L. Celona**, F. Chines, G. Cosentino, E. Messina, M. Re, D. Rizzo, V. Scuderi, F. Tudisco, A. Amato, L. Calabretta, G. De Luca, A. Pappalardo, S. Passarello, D. Rifuggiato, A. Rovelli, *EXCYT: the RIB Project at INFN-LNS*, Nucl. Instr. & Meth B 261, p. 1040, (2007)
- 5) **L. Celona**, G. Ciavola, F. Consoli, S. Gammino, F. Maimone, P. Spaedtke, K. Tinschert, R. Lang, J. Mader, J. Rosbach, S. Barbarino, R.S. Catalano, D. Mascali, *Observations of the frequency tuning effect in ECR ion sources*, Rev. Sci. Instr. 79 (2008) 023305
- 6) **L. Celona**, S. Gammino, F. Maimone, D. Mascali, G. Ciavola, *Observations of resonant modes formation in microwave generated magnetized plasmas*, Eur. Phys. Jour. D 61, 107-115 (2011)
- 7) S. Gammino, **L. Celona**, and D. Mascali, *Perspectives of Electron Cyclotron Resonance Ion Sources Beyond the Scaling Laws*, IEEE Trans.on Nuclear Science 63 (2) 1051-59 (2016)
- 8) **L. Celona**, L. Neri, S. Gammino, O. Leonardi, A. Miraglia, G. Torrisi, F. Chines, G. Calabrese, G. Manno, G. Castro, D. Mascali, M. Mazzaglia, A. Caruso, A. Spartà, A. Longhitano, *High intensity proton source and LEBT for the European Spallation Source*, 17th International Conference on Ion Sources, Ginevra, Svizzera, 15-20 October 2017, AIP Conference Proceedings
- 9) **L. Celona**, G. Castro, F. Chines, G. Costa, S. Gammino, O. Leonardi, S. Marletta, D. Mascali, A. Maugeri, L. Neri, F. M. Noto, S. Passarello, G. Pastore, A. Seminara, G. Torrisi, S. Vinciguerra, S. Di Martino, P. Nicotra, *Commissioning of the AISHa ion source at INFN-LNS*, 17th International Conference on Ion Sources, Ginevra, Svizzera 2017, AIP Conference Proceedings
- 10) L. Neri, **L. Celona**, *High stability microwave discharge ion sources*, Scientific Reports (2022) 12:3064 <https://doi.org/10.1038/s41598-022-06937-7> Nature portfolio

1. Full CV in English

RAMELLO Luciano

Full professor in Experimental Physics

Dipartimento di Scienze e Innovazione Tecnologica, Università del Piemonte Orientale

Director of the B. Sc. Degree in Physics (2005-2011)

Director of the B. Sc. Degree in Materials Science (2015-present)

Employment:

1981-1983 CERN Fellow, Experimental Physics division

1983-1991 Researcher, Università di Torino

1992-1994 Associate professor, Politecnico di Milano

1995-1998 Associate professor, Università di Torino

1998-2004 Associate professor, Università del Piemonte Orientale

2005-present Full professor, Università del Piemonte Orientale

Teaching:

Base Physics courses (Mechanics, Thermodynamics, Electromagnetism) and introductory Laboratory courses (Mechanics, Thermodynamics, Electricity, Optics) at the University for students majoring in Physics, Chemistry, Biology, Materials Science.

Course on Digital Electronics for students of Computer Science.

Advanced courses on Particle Physics, Electronics and Radiation Detectors for students majoring in Physics.

Course on "Data Analysis Techniques" for Ph.D. students (Universities of Torino and Piemonte Orientale).

Short course on "Heavy Ion Physics" for Ph.D. students (Bologna 1999, Trieste 2001, Bologna 2003).

Tutoring:

Several theses for the Master degree in Physics and for the Ph.D. degree in Physics at Università di Torino and Università del Piemonte Orientale.

Several B.Sc. theses for students in Materials Science and Computer Science at Università del Piemonte Orientale.

Present research programs:

1. ALICE (A Large Ion Collider Experiment) at CERN: analysis of data taken in pp, p-Pb and Pb-Pb collisions up to 13 TeV (pp) and 5 TeV/nucleon, particularly for the Internal Tracking System (ITS); development, construction and commissioning for the ITS2 detector, based on Monolithic Active Pixel Sensors, for the Upgrade of the experiment in view of LHC Run 3.
2. FragmentatiOn On Target (FOOT) experiment: precision measurement of fragmentation cross-sections of light ions, aimed at improving treatment plans in Hadron Therapy and radioprotection for space missions.

Scientific responsibilities:

10/2011–10/2015 Coordinator of INFN's "Gruppo collegato" in Alessandria

2007-present Coordinator of the INFN-ALICE group in Alessandria

2005-2011 Coordinator of the Soft Physics Working Group of the ALICE Collaboration, CERN

2003-2005 Unit coordinator for Alessandria of the European Project ALFA-II-0042-FA
"Development of a silicon detector for photon counting to be used in dual energy digital radiography in the range 18-40 keV"

1993-2005 National coordinator of the INFN IPER experiment (part of NA50 at CERN SPS)

Scientific Board membership:

2011-2013 Member of the SPS Experiments Committee (SPSC), CERN

Awards:

Academia de Ciencias de Cuba, Premio Nacional: Diploma en reconocimiento al resultado de la investigacion cientifica "Empleo de detectores de particulas de alta energia para la generacion de imagenes radiograficas digitales", otorgado a los autores: Ana Ester Cabal Rodriguez, Luciano Ramello y otros (18 febrero 2006)

Conference talks (since 1997):

Charmonium production in Pb-Pb interactions at 158 GeV/c per nucleon, XIII Int. Conf. on Ultrarelativistic Nucleus--Nucleus Collisions (Quark Matter 1997), Tsukuba, Japan, December 1-5, 1997;

New Results on Intermediate Mass Dileptons, Quarkonium Production in Relativistic Nuclear Collisions, Brookhaven, September 28 - October 2, 1998;

Evidence for deconfinement from the J/ψ suppression pattern in Pb-Pb collisions by the NA50 experiment, Confinement IV, Vienna, July 3-8, 2000;

Results on leptonic probes from NA50, XVI Int. Conf. on Ultrarelativistic Nucleus--Nucleus Collisions (Quark Matter 2002), Nantes, France, July 18-24, 2002;

X-ray imaging with a silicon microstrip detector coupled to the RX64 ASIC, Fourth International Workshop on Radiation Imaging Detectors (IWORID 2002), Amsterdam, The Netherlands, September 8-12, 2002;

Results about imaging with silicon strips for angiography and mammography, presented at the VII Mexican Symposium on Medical Physics, Mexico City, March 26-26, 2003;

Recent advances on X-ray imaging with a single photon counting system, Memorias del 4to Simposio Internacional de Tecnicas Nucleares y Conexas NURT 2003, 27-31 Oct. 2003, La Habana, Cuba;

A Silicon Microstrip System equipped with the RX64DTH ASIC for dual energy mammography, 2004 IEEE NSS-MIC Conference Record, Rome;

Medical Imaging with Semiconductor Detectors, in O. Rosas-Ortiz, M. Carbajal and O. Miranda (Eds), Advanced Summer School in Physics 2005, Mexico City;

Working Group Report: Heavy-ion physics and quark-gluon plasma, Proc. of the DAE-BRNS Ninth Workshop on High Energy Physics Phenomenology (WHEPP-9), Bhubaneswar, 3-14 January 2006;

First physics with heavy ions in ALICE, Proc. of the Hadron Collider Physics Symposium 2007, La Biodola, Isola d'Elba, Italy, May 20-26, 2007;

First heavy ions at LHC - inclusive production, correlations and heavy flavours, Proc. of the XXth Hadron Collider Physics Symposium, Evian, France, November 16-20, 2009;

Soft QCD results from the ALICE experiment, Physics at LHC 2011 Conference, Perugia, Italy, June 6-11, 2011;

ALICE results on Heavy Ion Physics at LHC, XXVI Rencontres de Physique de la Vallee d'Aoste, La Thuile, Italy, February 26 - March 3, 2012;

Heavy ion physics at LHC: present and future, IFAE 2012, Ferrara, April 11-13, 2012 ;

Recent results of Pb-Pb and p-Pb collisions from ALICE, 2nd International Conference on New Frontiers in Physics, Kolymbari, Crete, Greece, August 28 – September 5, 2013;

Physics results from ALICE, Corfu Summer Institute 2015 "School and Workshop on Elementary Particle Physics and Gravity", 3-21 September 2014, Corfu, Greece;

Heavy Ions: Signatures and precise measurements, XXXVI Physics in Collision, Quy Nhon, Vietnam, September 13-17, 2016.

Conference organization:

Quark Matter 2018 (27th International Conference on Ultrarelativistic Nucleus-Nucleus Collisions),
Venezia 14-19 May 2018: member of the Organising Committee.

Publications (last 15 years, 2005-2019):

Journal papers = 279, H-index = 74, Total Citations = 16781, Average citations per year = 1119.

(from Scopus on 18/12/2020)