



UNIVERSITÀ
degli STUDI
di CATANIA



DIPARTIMENTO DI **FISICA E ASTRONOMIA**
“**ETTORE MAJORANA**”

DOTTORATO DI RICERCA IN FISICA
CICLO XL A.A. 2024/2025

ADVANCED TOPICS IN NUCLEAR DYNAMICS AND REACTION MECHANISMS WITH STABLE AND RADIOACTIVE BEAMS

2 CFU

Teaching staff:

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Reception hours: Monday 15-17

Program of the course:

1-Production techniques of RIBS (radioactive ion beams)

- a) Isol and in-flight methods
- b) from the beam production to the tagging

2-HI nuclear reactions mechanism from low to intermediate energy

- a) physics case (complete and incomplete fusion, multifragmentation, equation of state, symmetry energy, isospin effects)
- b) experimental methods to select reaction mechanism
- c) experimental devices

Bibliography:

1 - Production techniques of RIBS (radioactive ion beams)

- Blumenfeld Y, Nilsson T and Van Duppen P, Facilities and methods for radioactive ion beam production, 2013 Phys. Scr, T152 014023
- Lombardo et al. Use of Large Surface MicroChannel Plates for the Tagging of Intermediate Energy Exotic Beams, Nuc. Phys. B - Proceedings Supplements 215 (2011), 272-274,

<https://doi.org/10.1016/j.nuclphysbps.2011.04.028>.

- Nuclear Physics Mid Term Plan @LNS and LNL – EPJ accepted for publication

2- HI nuclear reactions mechanism from low to intermediate energy

- S. Pirrone, G. Politi, **B. Gnoffo**, ..., et al.: "isospin influence on fragments production in $^{78}\text{Kr}+^{40}\text{Ca}$ and $^{86}\text{Kr}+^{48}\text{Ca}$ collisions at 10 MeV/nucleon", *EPJ A* 55, 22, (2019) [10.1140/epja/i2019-12695-4](https://doi.org/10.1140/epja/i2019-12695-4)
- Russotto, P., Cozma, M.D., De Filippo, E. *et al.* Studies of the equation-of-state of nuclear matter by heavy-ion collisions at intermediate energy in the multi-messenger era. *Riv. Nuovo Cim.* **46**, 1–70 (2023). <https://doi.org/10.1007/s40766-023-00039-4>
- E. De Filippo, A. Pagano, P. Russotto et al., Correlations between emission timescale of fragments and isospin dynamics in $^{124}\text{Sn}+^{64}\text{Ni}$ and $^{112}\text{Sn}+^{58}\text{Ni}$ reactions at 35 A MeV. *Phys. Rev. C* 86, 014610 (2012). <https://doi.org/10.1103/PhysRevC.86.014610>
- P. Eudes, Z. Basrak, F. Sébille, V. de la Mota, and G. Royer Comprehensive analysis of fusion data well above the barrier, *Phys. Rev. C* **90**, 034609 – Published 12 September 2014, <https://doi.org/10.1103/PhysRevC.90.034609>