Groupe Transverse Nuclear Physics in the Cosmos

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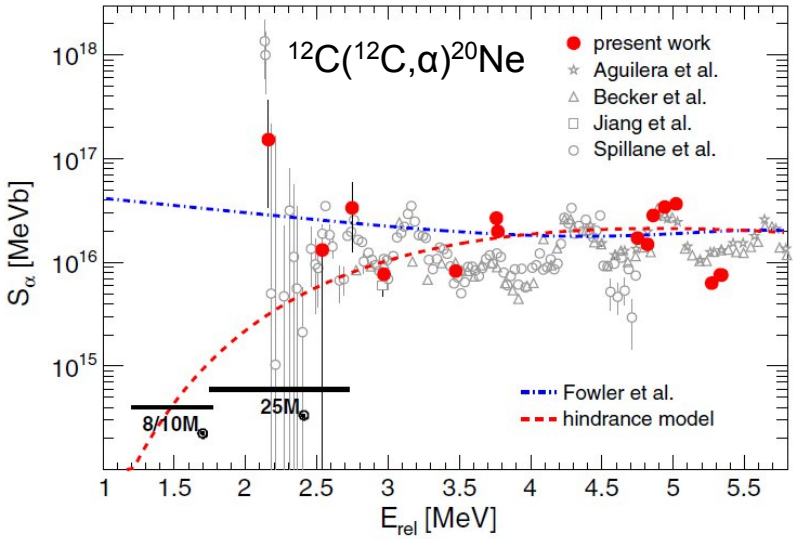
Nucleosynthesis

- Experimental determination of key cross-sections
  - astrophysical sites: intermediate and massive stars, binary system with one compact object (classical novae, X-ray bursts)
  - experimental sites: ALTO, GANIL, TRIUMF...

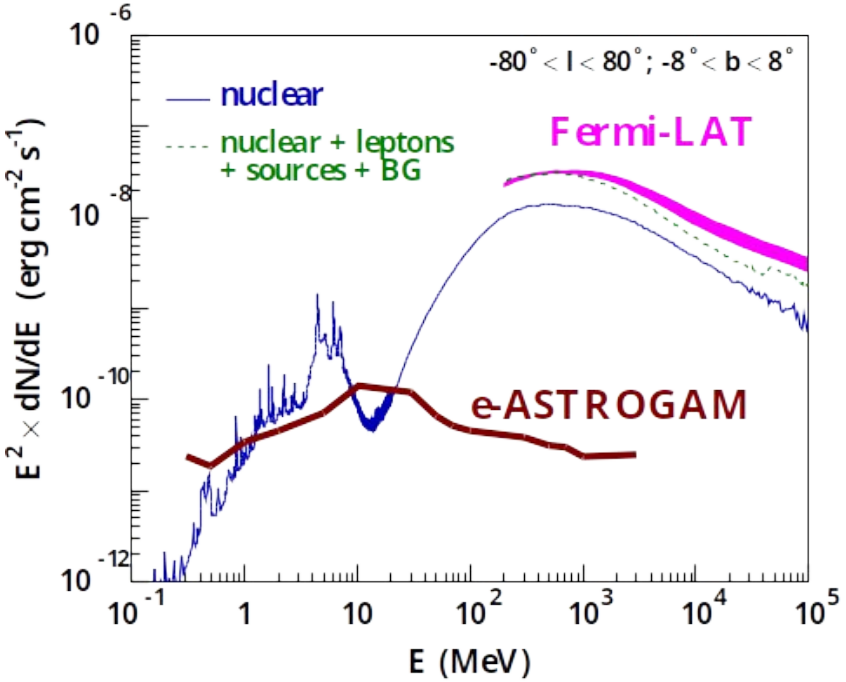


- Gamma-ray astronomy in the MeV range
  - prepare the future European mission (e-ASTROGAM, co-PI IJCLab)
  - local R&D: ComCube (Gamma-ray bursts polarimetry)

Cosmic rays & nuclear physics

- Gamma-ray line emission from interaction of cosmic rays with the interstellar medium → **impact of low-energy cosmic rays on star formation and Galaxy evolution**

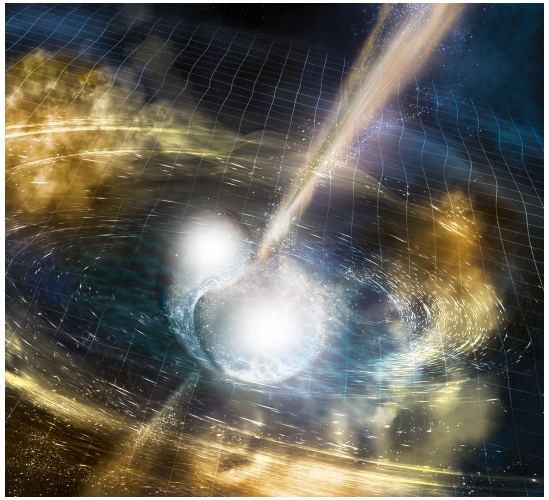
- Production of Li, Be and B and secondary cosmic-rays by spallation → astrophysical **origin of Galactic cosmic rays** (new Master Project INTERCOS)

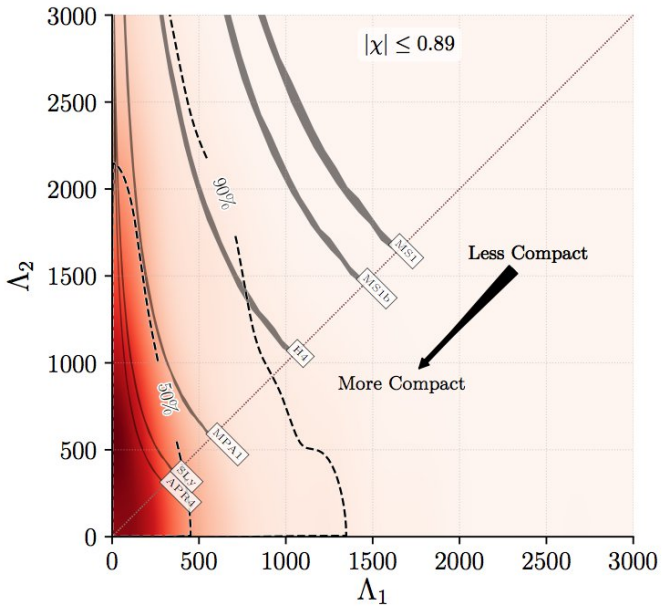


- Origin of UHECRs: **PANDORA** project (Photo-Absorption of Nuclei and Decay Observation for Reactions in Astrophysics)
  - Coulomb dissociation & photodissociation measurements at iThemba LABS (South Africa), RCNP (Osaka) & ELI-NP (Romania)
  - UHECR propagation -> comparison with data from the **Pierre Auger Observatory**

Dense matter - gravitational waves

- GW waveforms allowed to add constraints on nuclear matter through deformation of the neutron star in coalescing system including at least one neutron star
- Possible electromagnetic counterparts of the coalescence of two neutron stars is a kilonovae where nucleosynthesis of heavy elements will occurred (*r*-process) - GW170817
- Possible also to test General relativity or new theory of gravitation using black holes or neutron star systems observed with GW
- If a supernovae could be observed (within our galaxy or close-by ones) in GW, this will also bring information on nuclear matter.
- Effect of neutron star crust elasticity and superfluidity on GW signals?





Our goals

- Build local community from theory to experimentalists and observers

- Trigger discussions between interested people on common topics within IJCLab
  - Interest for astrophysical processes and associated measurements (*r*-process ?)
  - Development of new theoretical research directions in connection with local experimental activities (testing GR vs LIGO/Virgo data?)

- Strengthen existing collaborations within IJCLab
  - cross-section measurements campaigns
  - participate to science cases for new projects (e-Astrogam, Einstein Telescope, ...)

- Discuss possible links with GDRs/PNs : RESANET, GW, PNHE, ...

Foreseen actions

- Seminars
  - about one per month (regular day and time, tbd)
  - input from the members of the GT are welcome

- Mini workshops
  - typically half a day — a day
  - about twice a year
  - one or two external invited speakers (depending on budget)

How to join and participate

- Mailing list: NUCLCOSMOS-IJCLAB-L@IN2P3.FR
  - created end of May 2021
  - announcement of GT creation on June 2021
  - everybody can subscribe

Today

- Get to know each other
  - Short presentations and discussions about the science
- Identify common interests
  - Open discussion