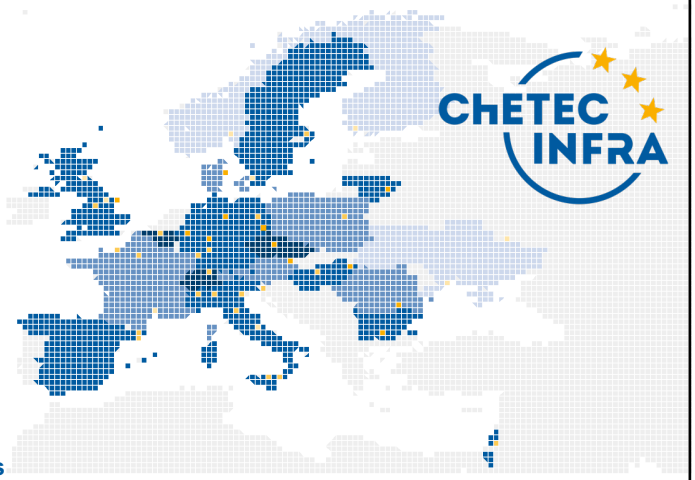
ChETEC-INFRA (2021-2025, nuclear astrophysics) [ketek-infra]

- **Ch**emical **E**lements as **T**racers for the **E**volution of the **C**osmos – **Infra**structures for Nuclear Astrophysics
- EU Horizon 2020 **Starting Community of Research Infrastructures**
- H2020-INFRAIA-2020-1
- **31 partners** in 17 EU+ countries
- 1 May 2021 – 31 October 2025
- 5.0 M€ support by European Union
- **14 research infrastructures** offer EU-supported transnational access, selection based on scientific merit
- **Outreach** to PhD students, high school students
- ChETEC-INFRA legacy: many **online databases**



https://www.chetec-infra.eu

Coordination:
HZDR, Germany

HZDR HELMHOLTZ ZENTRUM DRESDEN ROSSENDORF

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ChETEC-INFRA: 14 nuclear astrophysics research infrastructures

accelerators

telescopes

supercomputer

5039 beam hours at accelerators, 39 nights at telescopes, 3.9 M cpu-hours

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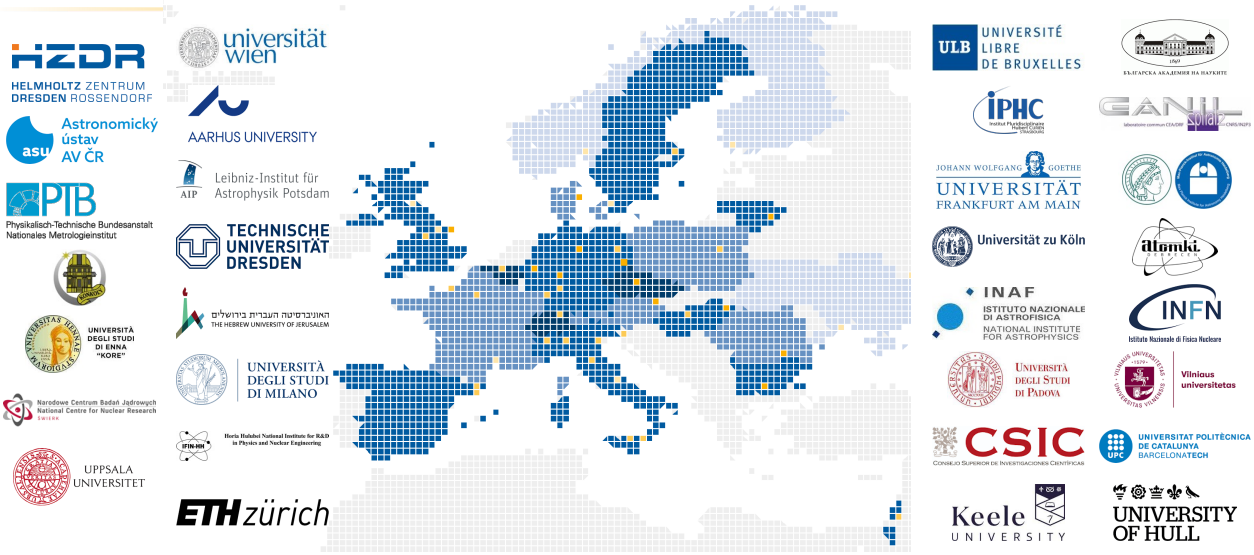
31 funded partners in EU, UK, Israel ….



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ChETEC-INFRA and hadron physics scientific overlap

- Experiment MAGIX @ MESA Mainz on the $^{12}C(\alpha,\gamma)^{16}O$ reaction – stellar helium burning (NuPECC LRP, p. 28)
- χEFT (Chiral Effective Field Theory) based calculations for $^{3}He(\alpha,\gamma)^{7}Be$ – Big Bang & solar neutrinos (Box 2.5 in NuPECC LRP, p. 29)
- Equation of State of neutron star matter – link to gravitational waves and neutron star mergers (Einstein Telescope) and to their multimessenger observations (nuclear astrophysics)
- Joint technical developments: Gas jets, and their characterization
- ECT* as a hub for theory in hadron physics and nuclear astrophysics

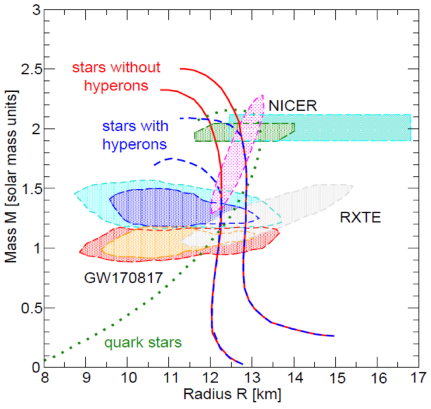

Fig. 2.9: The blobs represent the mass and radius constraints from the gravitational wave detectors LIGO and Virgo, as well as NASA's Neutron star Interior ExploreR (NICER), while the dashed and solid lines represent the predictions obtained with various EoS models, with and without hyperons. Picture credit I. Vidana (Universita di Catania).

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ChETEC-INFRA, possible way forward, for Hadron Physics 2025

0.9 M€ transnational access (including travel) for small labs and medium size telescopes

- 9 small accelerators of different capabilities (Austria, Germany, Hungary, Italy, Romania) – list can evolve
- Central European telescopes (Moletai/LT, Ondrejov/CZ, Rozhen/BG)
- Nordic Optical Telescope (Canary Islands – operated through Danish-Finnish consortium)
- One supercomputer (viper Hull/UK)

0.5 M€ virtual access for nuclear astrophysics web-based tools

- Databases (see separate page) and online tutorials, to be made sustainably accessible and to grow.

0.6 M€ networking activities

- 0.2 M€ nuclear astrophysics schools (Santa Tecla, Rußbach, Sinaia, NPA, etc.)
- 0.2 M€ scientific outreach, to planetary science community (meteorites)
- 0.2 M€ outreach to high school students (Nuclear Astrophysics Masterclasses)

0.4 M€ jet gas targets, both for hadron physics and for nuclear astrophysics

- Alfons Khoukaz / Uni Münster et al.

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ChETEC-INFRA-produced databases for virtual access provision

Databases and datasets	Weblink
Barium Star Repository	https://github.com/Milne-Centre/Barium-Star-Repository
Reaction Network Generator – NetGen	http://www.astro.ulb.ac.be/Netgen/
New Generation of Solar Models	https://doi.org/10.5281/zenodo.10822316
Nuclear Reaction Rates – ChANUREPS	http://chanureps.chetec-infra.eu
Stellar Trajectories – ORChESTRA	https://zenodo.org/communities/chetec-infra-wp4
s-process Library – ASTRAL	https://exp-astro.de/astral
Solar Fusion Library (Solar Fusion III)	https://doi.org/10.5281/zenodo.13945119
3D NLTE Abundance Correction Grid	https://www.chetec-infra.eu/3DNLTE/
Database of stable isotope anomalies in bulk meteoritic materials	https://chetec.csfk.org/

Task: Organize the databases (all were created by EU funds in the ChETEC-INFRA project) via one common, long term sustainable interface, and grow them further.

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