

# PUSHing Core-Collapse Supernovae to Explosions in Spherical Symmetry: Explodability and Global Properties

K. Ebinger<sup>a,b</sup>, S. Curtis<sup>b</sup>, C. Fröhlich<sup>b</sup>, M. Hempel<sup>c</sup>, A. Perego<sup>d</sup>, M. Liebendörfer<sup>c</sup> and F.-K. Thielemann<sup>a,c</sup>

<sup>a</sup>*GSI Helmholtzzentrum für Schwerionenforschung GmbH, 64291 Darmstadt, Germany*

<sup>b</sup>*Department of Physics, North Carolina State University, Raleigh NC 27695*

<sup>c</sup>*Departement für Physik, Universität Basel, CH 4056 Basel, Switzerland*

<sup>d</sup>*Istituto Nazionale di Fisica Nucleare, Sezione Milano Bicocca, 20126 Milano, Italy*

Core-collapse supernovae (CCSNe) are energetic explosions occurring at the end of the evolution of massive stars that provide the conditions for the synthesis of elements beyond iron and contribute to the galactic chemical evolution. Decades of research have not fully uncovered the detailed mechanism behind these complex explosions. Multi-dimensional simulations are crucial to investigate the mechanism, but computationally too demanding to investigate global properties of large samples of progenitor models. For this, spherically symmetric simulations are still the best-suited tool at the present time. The PUSH method [1] represents a well-suited parametrized framework to investigate the neutrino-driven mechanism in one-dimensional simulations to efficiently study important aspects of CCSNe like the effects of the shock passage through the star, the progenitor-remnant connection [2] and explosive nucleosynthesis [3]. With a calibration of the method to SN1987A and other observed CCSNe we explore the explodability and global properties of CCSN simulations for a large mass range of available solar metallicity progenitors. We find, among other properties, the explosion energies, ejected nickel masses, and remnant masses for the investigated progenitor samples and predict the resulting neutron star and black hole birth mass distributions.

## References

- [1] A. Perego, M. Hempel, C. Fröhlich, K. Ebinger *et al.*, *ApJ* **806**, 275 (2015).
- [2] K. Ebinger, S. Curtis, C. Fröhlich *et al.*, (submitted for publication).
- [3] S. Curtis, K. Ebinger, C. Fröhlich *et al.*, (submitted for publication).