

## The Structure and Signals of Neutron Stars, from Birth to Death



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# Sound modes and instabilities in a relativistic superfluid

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Compact stars are likely to contain superfluid matter, either in the form of nuclear or quark matter, or both. The hydrodynamics of superfluids is usually described in terms of a two-fluid model. I will discuss how such a two-fluid model can be derived from field theory and apply the results to compute the properties of first and second sound for arbitrary temperatures and (uniform) superfluid velocities. I will also discuss the two-stream instability - known from plasma physics - that manifests itself in an unstable sound mode and that is potentially relevant for the fluid dynamics in the interior of the star.

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