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Aspects of nuclear pairing[1]

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Pairing correlations between nucleons are known to be one of the major driving forces behind the nuclear many-body dynamics. The collective effects resulting from pairing play a crucial role in many nuclear properties. Despite a long history the methods of treating pairing along with corresponding questions and problems have constantly evolved. The role of pairing in exotic nuclei where superconducting phase competes with particle instability will be addressed in this presentation. Apart from this, the mesoscopic nature of the problem also accentuates other problems such as interplay of pairing and collective effects including rotations and deformations. The extended pairing phase transition, instability to large fluctuations and related thermodynamical properties are inseparable components of nuclear superconductivity. In this presentation I will explore these questions highlighting simultaneously the novel methods and techniques. The method of Exact Pairing (EP) is based on the algebraic treatment of pairing that relies on quasispin algebra. Recently the EP has evolved into a powerful technique that provides an exact numerical solution to the many-body problem. The EP serves as a foundation for understanding of manifestations of pairing in mesoscopic systems, and provides some answers to the above questions. The method allows for far-reaching extensions such as inclusion of collective dynamics within Random Phase Approximation, treatment of interactions beyond pairing and exploration of continuum of reaction states. Considering pairing within a rotating deformed proton emitter I will address its effect on particle emission. The kinematical suppression of the recoil, known as Coriolis attenuation, due to the superfluid nature of the rotating core is of special interest.

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