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A new experiment on the radiative decay of the 12-C Hoyle state with charged-particle spectroscopy

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The Hoyle state in 12C (7.654, 0+) is a famous clustered state whose peculiar properties are key for determining the rate at which carbon, one of the most abundant elements in the Universe, is forged in stars. The competition between alpha- and radiative- decays of this peculiar state crucially affects the relative abundance of carbon and oxygen in the Universe and the mass limits for the formation of black holes. However, a strong tension in the determination of its radiative decay branching ratio characterizes recent experimental works, posing major implications on the aforementioned fundamental aspects of nucleosynthesis and stellar evolution. This talk describes an almost background-free measurement of the radiative decay branching ratio of the Hoyle state that exploits charged particle coincidence techniques. The experiment adopts several methodologies to minimize the background and identify the signal associated with the radiative decay. Large care is devoted to having under full control two of the major sources of systematic errors in particle-coincidence experiments: the coincidence efficiency and the spurious coincidence rate. The new findings help to resolve the strong tension between recent data published in the literature.

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