The HEAT project: Study of hydrogen desorption from carbon targets

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HEAT (Hydrogen dEsorption from cArbon Targets) is a new project started in 2018 with the aim of studying the desorption of hydrogen and deuterium contaminations from carbon targets used for Nuclear Astrophysics studies, with special reference to the ^{12}C+^{12}C fusion reaction.
^{12}C+^{12}C fusion is the dominant process during stellar carbon burning and its cross section is a crucial parameter in modern astrophysics, given its strong influence on stellar evolution and nucleosynthesis. In stars, the ^{12}C+^{12}C reaction occurs at center of mass energies well below the Coulomb barrier. This makes the cross section extremely small and challenging to measure.
The direct measurements of the ^{12}C+^{12}C cross section performed so far were affected by a strong beam induced background due to the interaction of the carbon beam with hydrogen and deuterium contaminations inside the targets.
Due to the ease of forming chemical bonds with carbon, hydrogen is always found in carbon targets. In previous measurements of the ^{12}C+^{12}C cross section attempts were made to desorb hydrogen by heating the samples, but only limited quantitative information is available on the effectiveness of the desorption procedure.
The HEAT experiment aims at establishing a reproducible technique for hydrogen desorption from different types of carbon targets. The temperature of the samples will be increased uniformly up to 1200°C through a heating device with a well defined temperature gradient. The contamination level will be measured before and after the desorption process exploiting two independent techniques: Elastic Recoil Detection Analysis and Nuclear Reaction Analysis.
The poster will provide a detailed description of the experimental setup presently under construction at Legnaro National Laboratories and the proposed experimental approach.