The $^{3}He(^{4}He,\gamma)^{7}Be$ experiment at the underground LUNA facility in Gran Sasso (Italy)

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LUNA (Laboratory for Underground Nuclear Astrophysics) is an international Collaboration (Germany, Hungary, Italy, Portugal) aimed to the direct measurement of cross section of nuclear reactions of astrophysics interest. The Collaboration manages a 400 kV electrostatic accelerator installed in the underground laboratory of Gran Sasso (LNGS), in Italy. Thanks to the extremely low cosmic rays background and to the high luminosity of the beam, several important reactions have been studied in the past at extremely low energies and, in some cases, inside the energy window of the Gamow peak. The latest results have been obtained in the study of the $^{14}N(p,\gamma)^{15}O$ reaction: the cross section has been measured down to 70 keV c.m. The LUNA Collaboration is presently working on a new experiment i.e. the study of the $^{3}He(^{4}He,\gamma)^{7}Be$ by the counting of the prompt γ emission and of the delayed ^{7}Be activity. So far several groups have studied this reaction resulting in two sub-sets of results (i.e. experiments on prompt and delayed γ counting) which show a systematic disagreement of about 17%. Recent and precise determination of solar neutrinos fluxes require a further investigation of the $^{3}He(^{4}He,\gamma)^{7}Be$ cross section at the lowest possible energy. An overview of the scientific problem and a description of the experimental set-up presently under installation at LNGS will be given. The goal is to measure the reaction cross section down to 60 keV with total accuracy lower than 4%.