First evidence of di-proton decay from ^{18}Ne excited states.

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The availability of elements near the proton drip-line as radioactive beams opens several opportunities to search for di-proton cluster decay. Previous investigations [1] on ^{18}Ne excited states suggest that the 6.15(1^-) MeV level could be a good candidate for two-proton emission. In the present experiment we used a tagged ^{18}Ne beam selected among the fragmentation products of a primary ^{20}Ne beam at 45 AMeV on a ^{9}Be thick production target by using the FRIBS facility at LNS [2]. We expect to populate the 6.15(1^-) MeV level through the E1 Coulomb excitation of the ^{18}Ne projectile on a ^{208}Pb target. The detection system has been appropriately designed both to detect all the decay products and to discriminate between simultaneous or sequential diproton decay, by reconstructing the angular and energy correlation between the two-emitted protons. The procedure has been checked for the well-known ^{16}O stable nucleus by looking to the fully measured ^{12}C+α events. Figure 1-left shows preliminary CM excitation energy spectra of the selected decay channel ^{16}O+2p [1]. The two peaks corresponding to the decay of the 5.11 MeV (2^+) and 6.15 MeV(1^-) excited states of ^{18}Ne are recognized although partially superimposed. In addition, also high-lying states are, presumably, present. In figure 1-right is shown the relative momentum q spectrum of the two detected protons. The peak at 20 MeV/c indicates a strong correlation of the two decaying protons (di-proton resonance). The ^{18}Ne excitation energy spectrum in red, in figure 1-left, is reconstructed by using only the events in which the two protons have a relative momentum q between 10 and 30 Mev/c. Present results show unambiguously that low energy ^{18}Ne states two proton decay proceeds through a true ^{2}He resonance (diproton) with an high branching ratio.

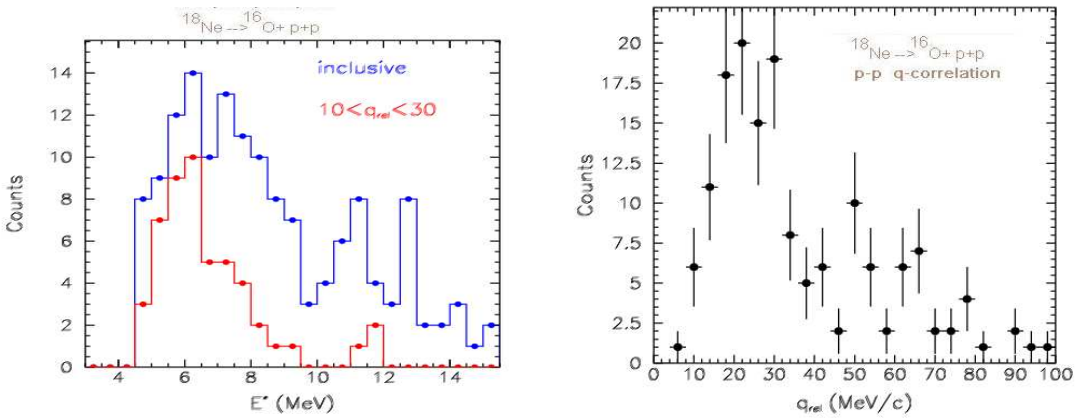

Figure 1: *Left: Excitation energy of the ^{18}O levels reconstructed by the ^{16}O+p+p decay. Red histogram: the same but selecting events in the relative momentum range 10-30 MeV/c. Right: relative momentum q correlation of the two decays protons.*

[1]J. Gomez del Campo *et al.* Phys. Rev. Lett **86**(2001)43; T. Zerguerras Orsay - PhD thesis [2]G. Raciti *et al.*, LNS Activity Report (2001) 59; G. Raciti *et al.*, Proceedings of the 10th Int. Conf. on Nuclear Reaction Mechanisms, Varenna (2003) 11; E. Rapisarda *et al.*, Abstracts of the RNB7 Conference, Cortina (2006), 27 E. Rapisarda *et al.*, Abstracts INPC 2007 [1]