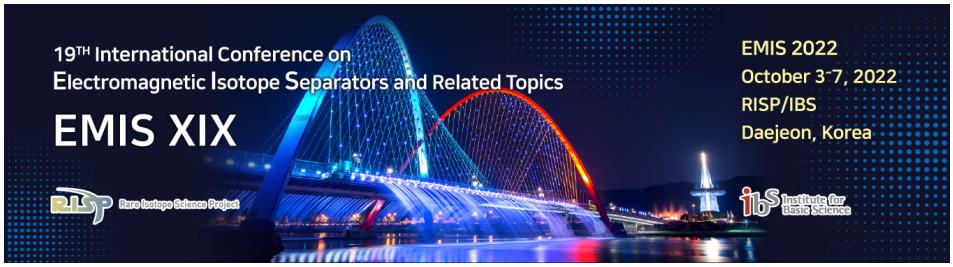

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First experimental campaign at the new fragment separator ACCULINNA-2: superheavy 6,7H isotopes elucidated

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Recently the extremely neutron-rich systems 7H, 6H were studied in the direct 2H(8He, 3He)7H and 2H(8He, 4He)6H transfer reactions [1-3] with a 26 AMeV secondary 8He beam produced at the new ACCULINNA-2 fragment separator [4]. The missing mass spectra and center-of-mass angular distributions of 7H(6H), as well as the momentum distributions of the 3H fragment in the 7H(6H) frame, were reconstructed.

A solid experimental evidence is provided that the resonant states of 7H are located in its spectrum at 2.2(5) and 5.5(3) relative to the 3H+4n decay threshold. Also, there are indications that the resonant states at 7.5(3) and 11.0(3) MeV are present in the measured 7H spectrum. Based on the energy and angular distributions obtained for the studied 2H(8He, 3He)7H reaction, the weakly populated 2.2(5)-MeV peak is ascribed to the 7H ground state (g.s.). It is highly plausible that the firmly ascertained 5.5(3)-MeV state is the 5/2+ member of the 7H excitation 5/2+ −3/2+ doublet, built on the 2+ configuration of valence neutrons. The supposed 7.5-MeV state can be another member of this doublet.

The measured missing mass spectrum of 6H shows a broad bump at ~ 4 – 8 MeV above the 3H+3n decay threshold. This bump can be interpreted as a broad resonant state at 6.8(5) MeV. The obtained spectrum is practically free of the 6H events below 3.5 MeV (center-of-mass cross section is less than 5 μb/sr in the 5-16 deg. angular range). The steep rise of the 6H missing mass spectrum at ~ 3 MeV allows to derive the lower limit for the possible resonant-state energy in 6H to be 4.5(3) MeV. According to the paring energy estimates, such a 4.5(3) MeV resonance is a realistic candidate for the 6H g.s.. The obtained results confirm that the decay mechanism of the 7H g.s. is the "true"(or simultaneous) 4n emission. The resonance energy profiles and the momentum distributions of fragments of the sequential 6H⟶ 5H(g.s.)+n ⟶ 3H+3n decay were analyzed by the theoretically-updated direct four-body-decay and sequential-emission mechanisms. The measured momentum distributions of the 3H fragments in the 6H rest frame indicate very strong "dineutron-type"correlations in the 5H ground state decay.

In addition, the proton and deuteron pickup reactions 2H(10Be,3He)9Li and 2H(10Be,4He)8Li were studied for the first time in the same setup with 44 AMeV 10Be radioactive beam. These measurements were motivated as test reactions to control the calibration and resolution over excitation energy for the studied 7H and 6H systems.

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