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Abstract for an Invited Paper
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Applications of Accelerators in Nuclear Science

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I will touch upon some of the highlights of the thirteenth international topical meeting on the applications of accelerators (AccApp'17), which convened July 31 to Aug. 4, 2017 in Québec City, Québec, Canada. I will focus on Photon Activation Analysis (PAA) as the bridge for the many applications of nuclear physics using accelerators. The basic equipment is an electron linear accelerator (LINAC) with an energy range up to 35 MeV together with a radiation spectroscopy laboratory capable of resolving the gamma lines from the activated nuclides. Due to their highly penetrating nature, high-energy bremsstrahlung photons can reveal information about elemental composition of samples of significant volumes. The high-energy photon interacts with the target nucleus and in the ensuing photonuclear reaction, a nucleon (proton or neutron) is ejected from the probed nucleus. Usually this nucleon is a neutron, as the Coulomb energy barrier will tend to inhibit protons from escaping. The resulting nuclide will be a proton-rich isotope of that interrogated element. In most cases, the isotope is unstable and this excited nuclide will cascade down to its ground state; usually through emitting several gamma rays, each having a characteristic energy ranging from ˜100 keV to several MeV. Measuring these discrete gamma rays will "fingerprint" the nuclide. In this talk, various applications of PAA, including environmental, biological, archeological, and forensic, will be reviewed. I will further present the PAA of airborne dust samples, lunar dust simulants, and volcanic dust samples. Additionally, the latest results of PAA on jade will be discussed. It will be shown that PAA can serve as a versatile and highly sensitive tool for identifying counterfeit gemstones.