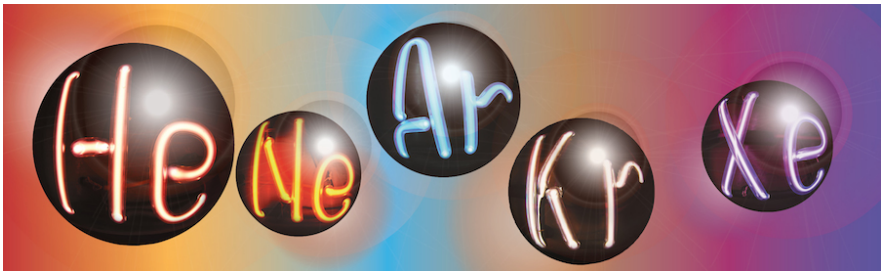

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Optical Spectroscopy of Pure Liquid Argon and Liquid Argon-Xenon Mixtures

Sunday, 24 September 2017 10:00 (20 minutes)

Electron- and ion-beam induced emission spectra of argon and argon-xenon mixtures were studied. A wide wavelength range from the vacuum ultraviolet (VUV) to the near infrared (IR) was covered (115nm –3500nm). An intense emission at a peak wavelength of 1.173 µm has been discovered in a mixture of 10ppm xenon in liquid argon which can be of interest for detector development. The well-known 127 and 174nm excimer emission features of argon and xenon, respectively, were recorded together with some weaker structures. Particle-beam excitation has the advantage that spectroscopic studies can be performed with good wavelength resolution and statistics because intense light emission can be induced. Intensities of 22000 and 13000 photons/MeV were measured for the VUV and IR emission, respectively, for ~10 keV electron-beam excitation. It was found that the so called third excimer continuum is weak in liquid argon, also with ion-beam excitation which is not the case for argon in the gas phase. Absorption measurements in the VUV have revealed that xenon is a critical impurity in detectors working with pure liquid argon. An absorption due to Xe appears right in the middle of the Ar excimer emission band. For well purified pure argon, however, the attenuation length was found to be at least 1.6m for its own VUV emission. A getter material was used for chemical purification and xenon was removed by condensation. In a recent experiment it was studied whether the intensity ratio between the IR and VUV emission from a 10ppm Xe in Ar mixture can be used for particle identification and thereby also background reduction in a liquid rare gas detector. Various projectiles with various particle energies from the Munich Tandem Van de Graaff accelerator were used to model the detector situation. An attempt is made to understand the results on the basis of energy deposition per unit volume, not only LET (linear energy transfer). Important technical details of all experiments will be described.

Summary

Emission and absorption spectroscopy of liquid argon and argon-xenon mixtures has been performed. An attempt is made to use VUV vs IR emission for particle identification.

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