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Optical Analysis of Plasma Ball Filaments SCOTT VASQUEZ, MICHAEL CAMPANELL, STEWART J. ZWEBEN, PPPL — Optical methods were used to study the properties of a commercial plasma ball. Using spectrometry, the gas composition of the plasma ball was analyzed. Spectra of known gases were compared with the plasma ball spectrum, confirming the presence of Neon and Xenon. The spectra indicate that faint amounts of Nitrogen may also be present. Photomultiplier tubes were used to measure the radial velocity of filaments in the plasma ball. Digital oscilloscope traces produced with the photomultiplier tubes show that the filaments propagate radially at an average velocity on the order of 10,000 m/s. Furthermore, these traces suggest that that the radial velocity decreases with increasing distance from the electrode. A hotwired commercial plasma ball, with connections for a pulse generator and Variac has been built, allowing for the study of filament velocity at different operating voltages and frequencies. A custom plasma ball whose parameters, such as gas mixture, pressure, electrode configuration, and applied voltage waveform can be varied, has also been constructed. Analysis of the custom plasma ball will give further insight to how such parameters affect the plasma ball's filament formation and behavior. Initial results will be presented. Ultimately, this custom plasma ball, along with the methods used to measure its properties, will be incorporated into an undergraduate physics lab.

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