Spectroscopy of laser-produced lanthanum plasmas in the 0.8 – 4.2 nm region

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The results of a spectroscopic study of soft x-ray emission from highly-charged lanthanum ions generated in a laser-produced plasma will be presented. The spectrum, recorded in the 0.8 – 4.2 nm region, exhibits both line and narrowband features. In terms of the former, the main contributors to the spectrum are $\Delta n > 0$ transitions in highly-charged Ni-, Cu-, Zn- and Ga-like ions. Interestingly, flexible atomic code (FAC) calculations of these spectra predict a near-coincidence in transition energy for numerous transitions originating from neighboring isoelectronic sequences. In certain cases, this hinders our ability to make unambiguous line identifications.

In addition to discrete line features, emission in the form of narrow, quasicontinuous bands are also observed throughout this spectral range. Below 2 nm, the most intense spectral features arise from $3d^n – 3d^{n-1}4f$ transition arrays in highly-charged Fe-like (n = 8) and Co-like (n = 9) lanthanum ions. The origin of intense narrowband features located above 2 nm has been attributed to transitions of the form $3d^9 4l – 3d^9 5l'$ (where l = 0 – 3, l' = 0 – 4) between excited-state Ni-like configurations. Analogous transition arrays in Fe- and Co-like lanthanide ions may also contribute to this spectral region. Where possible, comparisons will be made with previous experimental and theoretical studies of highly-charged lanthanum ion spectra [1 - 5].

References

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