

Observation and interpretation of emission spectra of free ions Nd^{3+} and Nd^{4+}

Jean-Francois Wyart,¹ Ali Meftah,¹ Nissan Spector,² Norbert Champion,³
Wan-Ü Lydia Tchang-Brillet³

¹ *Laboratoire Aimé Cotton (CNRS UPR 3321), Orsay, France*

² *Lab. Chimie Physique, Matière et Rayonnement, Université Paris 6, France*

³ *LERMA (CNRS UMR 8112), Observatoire de Paris-Meudon, Meudon,
France; also Université Pierre et Marie Curie_Paris 6*

jean-francois.wyart@lac.u-psud.fr

Domain : Low Temperature Laboratory Plasmas

Spectra produced by a sliding spark with a pure Nd anode were observed in the spectral range from 60 to 120 nm on the normal incidence 10.7m vacuum ultraviolet spectrograph at the Paris-Meudon Observatory. Earlier spectral plates produced at NBS, Gaithersburg on a similar instrument have completed our data at longer wavelengths. The source operating conditions were varied in order to select lines of Nd III to Nd V. Polynomial interpolation from impurity lines of ionized elements C, N, O, Al and Si led to Nd wavelengths with estimated errors of $\pm 0.003\text{Å}$ near 1300Å . In spite of many studies of Nd^{3+} in compounds, the atomic energy levels of this famous Nd-laser ion had never been derived from spark spectra. In a first step, 37 (out of 41 possible) levels of $4f^3$ were determined from $4f^3-4f^25d$ transitions and were described in various theoretical approximations [1]. The running extension of this work includes more than a half of the $4f^26s$ and $4f^26p$ levels but a complete theoretical description of Nd IV is hampered by the overlap of the latter configuration with $5p^54f^4$.

More recently, all levels of $4f5d$, $4f6s$ and $4f6p$ have been determined in Nd V and only the highest level of the ground configuration $4f^2$ is missing.

Trivalent lanthanide ions have many applications, for which the knowledge of the free ion spectra, atomic energy levels, radial parameters and transition probabilities are crucially important. After Nd IV and Tm IV [2], the spectra of Eu IV and Er IV will be investigated shortly.

[1] J.-F. Wyart, A. Meftah, A. Bachelier, J.Sinzelle, W.-U L. Tchang- Brillet, N. Champion, N. Spector and J. Sugar, J. Phys. B: At. Mol. Opt. Phys., 39 (2006) L77-L82.

[2] A. Meftah et al., in this Conference.