

### **Ignition of Aluminum Particles**

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# Ignition of Aluminum Particles

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# **Objective:**

Characterization of the ignition process of an isolated aluminum particle through visual information and temperature measurement. Results are compared to a simple model.



### Two-color ratio pyrometry:

- Photomultipliers equipped with interference filters
- $\lambda_1 = 720$  nm;  $\lambda_2 = 830$  nm to avoid emission lines of main gaseous species

Ratio of radiative intensities at different wavelengths:  $\Gamma = \frac{L_{\lambda_1}}{L_{\lambda_1}}$ 

- Levitating **charged particle** in a controlled atmosphere
- **Symmetrically heated** by a splitted CO2 laser beam ( $\lambda = 10.6$  nm)
- High speed PHANTOM camera combined with long distance microscope QUESTAR QM100 allowing a **1.92 \mum/px** magnification
- 39000 fps and 768x768 px resolution

- Absorption along the line of sight is neglected
- Grey body assumption and Planck's law:  $T = f(\Gamma, \lambda_1, \lambda_2)$
- Calibration made with a Quartz Tungsten halogen lamp

Temporally resolved, integrated temperature of the condensed phase



# Model Description:

- **Power source**: single Gaussian laser beam integrated on the projected surface of the particle. Absorption efficiency accounts for the amount of laser energy given to the particle. The remaining energy is scattered.
- **Power losses**: conduction, radiation  $\bullet$
- **Convection is neglected** due to the staticity of the particle and the absence of induced flow  $\bullet$
- Power used to **heat** and **melt** the particle
- Biot number  $Bi \ll 1$ : Temperature gradients inside the particle are neglected
- $\eta_{abs}$  linearly varying between 0.018 to 0.08













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