

# (TG3) Spectroscopy group report



Date: Oct. 26, 2022

Oct. 27, 2022 (T. Oishi)

Time: 9:37 – 10:50, 13:35 – 15:54

Shot#: 181544 – 181567, 181606 – 181650 (69 shots)

Prior wall conditioning: NO

Divertor pump: ON

Gas puff: H<sub>2</sub>, He, Ne, Ar, N<sub>2</sub>

Pellet: La, Ce, Pr, Nd, CaAl<sub>2</sub>O<sub>4</sub> (TESPEL), C, Nd (impurity pellet)

NBI#(1, 2, 3, 4, 5)=gas(H, H, H, D, D)=P(3.0, 4.1, 3.9, 5.1, 6.6)MW

ECH(56GHz)=ant(1.5-U)=P(0.289)MW

ECH(77GHz)=ant(5.5-U, 2-OUR)=P(0.703, 0.792)MW

ECH(154GHz)=ant(2-OLL, 2-OUL, 2-OLR)=P(0.723, 0.799, 0.825)MW

ICH(3.5U, 3.5L, 4.5U, 4.5L)=P(0, 0, 0, 0)MW

Neutron yield integrated over the experiment =  $5.6 \times 10^{15}$

## Topics

1. Ca TESPEL Injection for emission line diagnostics (H. Hara [NAOJ], I. Murakami)
2. Collection and assessment of the transition data required for the quantitative studies of heavy element (D. Kato)
3. Spectroscopy of highly charged heavy ions (C. Suzuki, F. Koike [Sophia Univ.]

# Ca TESPEL Injection for emission line diagnostics



H. Hara, Murakami, I., Kato, D., Oishi, T., Tamura, N. et al.

## Objectives:

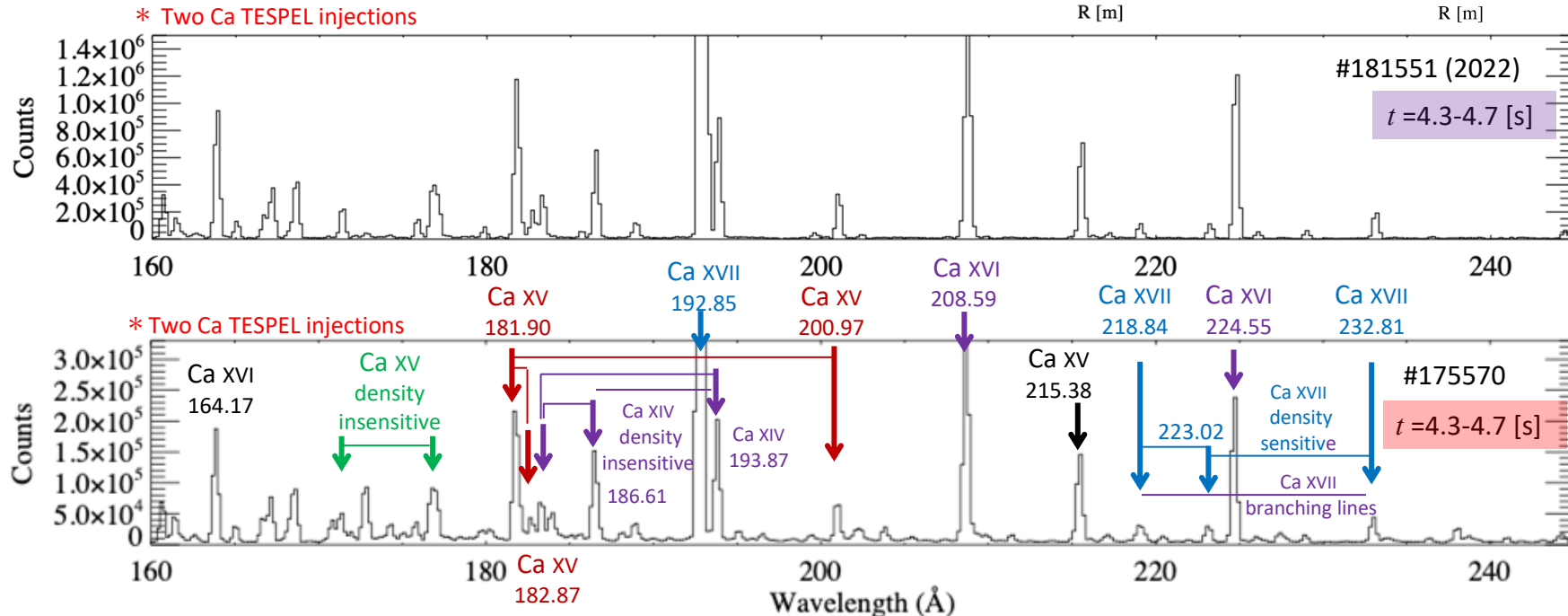
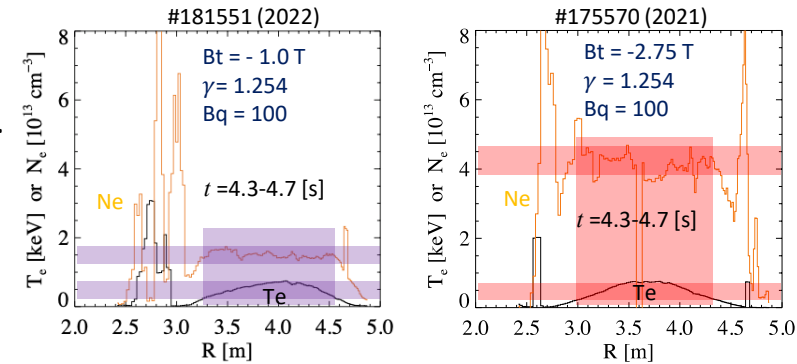
- Validation of plasma diagnostic capability by Ca emission line ratios for studying the solar corona

## Experimental Conditions:

- H gas,  $R_{ax}=3.9m$ ,  $Bt=-1T$ ,  $\gamma=1.254$ ,  $Bq=100$
- Ca contained TESPEL injection at 4.25 sec
- #181548-#181567 (20 shots)

## Results:

- We have clearly detected Ca XVII, Ca XVI, Ca XV & Ca XIV lines.
- Ca line intensities have increased by a factor of 4-5. Ca lines of interest look less blending.



# TG3: Collection and assessment of the transition data required for the quantitative studies of heavy element

Proponent: D. Kato

Co-authors: N. Nakamura (UEC), M. Tanaka (Tohoku Univ), M. Goto, T. Oishi, H.A. Sakaue, I. Murakami, T. Kawate, G. Gaigalas (Vilnius Univ)

## Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, 2.75 \text{ T}, 1.2538, 100.0\%)$ , #181606 - #181626, NBI#1-5, ECH (start), H2 gas

## Objectives

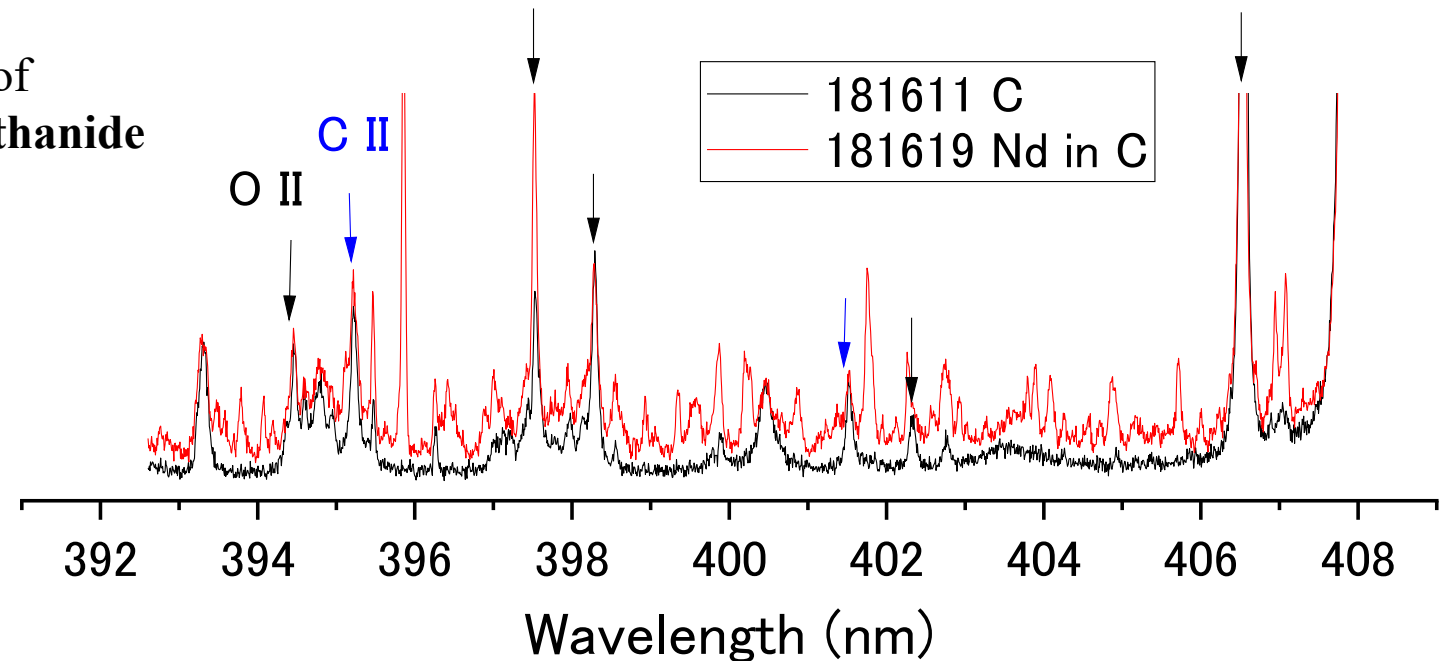
Measurements of high-resolution visible spectra of ablation cloud of Nd (**one of largest opacity lanthanide element in kilonovae**).

## Experiments

Carbon pellets containing Nd powders (200 $\mu\text{g}$  in average) were injected by impurity pellet at 4.0s. NBI#1-3 were injected at 3.3-5.3s and NBI#4-5 were injected at 5.3-7.3s.

## Preliminary results

Wavelengths are calibrated using O II and C II lines (black and blue arrows). Many emission lines are presumably assigned to Nd (mostly Nd II). We will identify these lines assuming LTE condition.



# Spectroscopy of highly charged heavy ions (C. Suzuki, F. Koike)

**Objective:** In order to cover the missing wavelength ranges of the spectral database of lanthanide ions, we try to measure soft X-ray/EUV spectra of La, Ce, Pr, and Nd injected by TESPEL.

## Experimental conditions:

$(R_{ax}, \text{Polarity}, B_t, \gamma, B_q) = (3.6 \text{ m}, \text{CCW}, -2.75 \text{ T}, 1.2538, 100.0\%)$  #181627–181647

## Experiment:

The four heavy elements were injected into NBI plasmas with electron density of  $(5-7) \times 10^{19} \text{ m}^{-3}$  and electron temperature of about 2 keV. Spectra in the wavelength range of approximately 7–34 nm were measured by SOXMOS and EUV spectrometers.

## Results:

The discrete and UTA spectra were observed for some of the elements. In particular, high temperature spectra of Ce ions in a new wavelength range were clearly observed as shown in the figure.

