

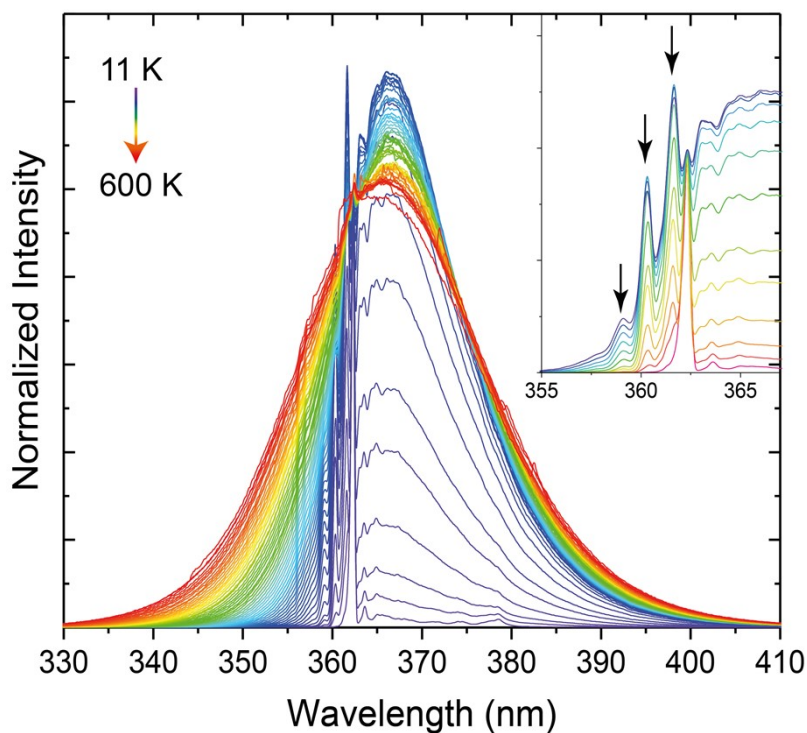
## Supporting Information

### Eu<sup>2+</sup> emission from thermally coupled levels – new frontiers for ultrasensitive luminescence thermometry

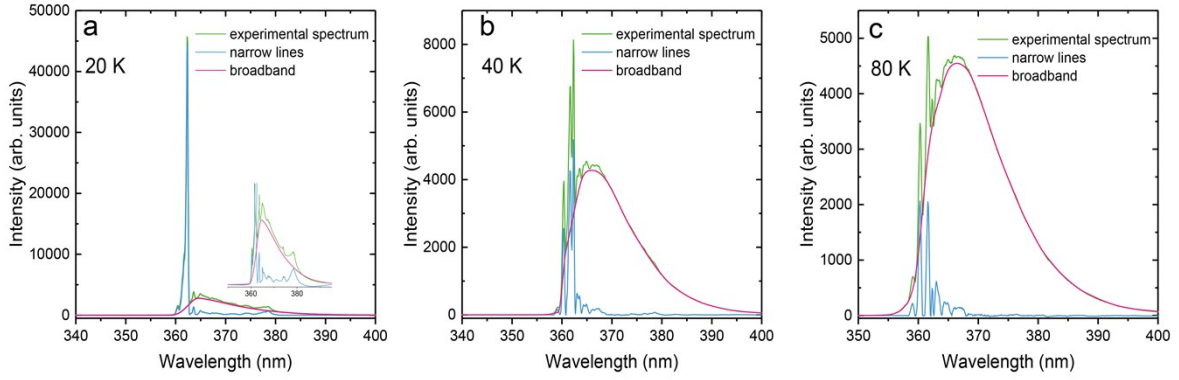
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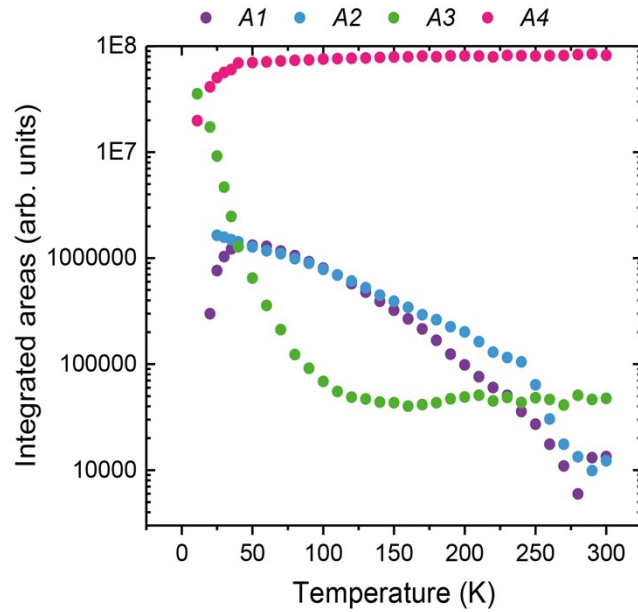
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**Figure S1.** The temperature-dependent luminescence spectra of SrB<sub>4</sub>O<sub>7</sub>:Eu<sup>2+</sup> recorded in the range of 11 – 600 K. The inset presents three of Stark components.



**Figure S2.** Presentation of the strategy of extraction of the broadband luminescence representing presumably the  $5d \rightarrow 4f$  transition and the narrow lines resulting from the  $4f \rightarrow 4f$  transitions complemented with their vibronic components.



**Figure S3.** Thermal evolution of integrated areas of the  $\text{SrB}_4\text{O}_7:\text{Eu}^{2+}$  phosphor.

**Table S1.** Fitting parameters delivered by the polynomial functions for all  $\Delta$  parameters of the  $\text{SrB}_4\text{O}_7:\text{Eu}^{2+}$  phosphor.

$\Delta$	A0	A1	A2	A3	R <sup>2</sup>
$\Delta_1$	1.38	0.006	-7.63E-6	6.71E-8	0.997
$\Delta_2$	1.18	0.01	-6.87E-5	1.94E-7	0.995
$\Delta_3$	-1.19	0.09	-7.02E-4	1.79E-6	0.997
$\Delta_4$	-3.62	0.14	-1.46E-4	5.25E-6	0.994
$\Delta_5$	-2.50	0.09	-7.93E-4	2.62E-6	0.996