

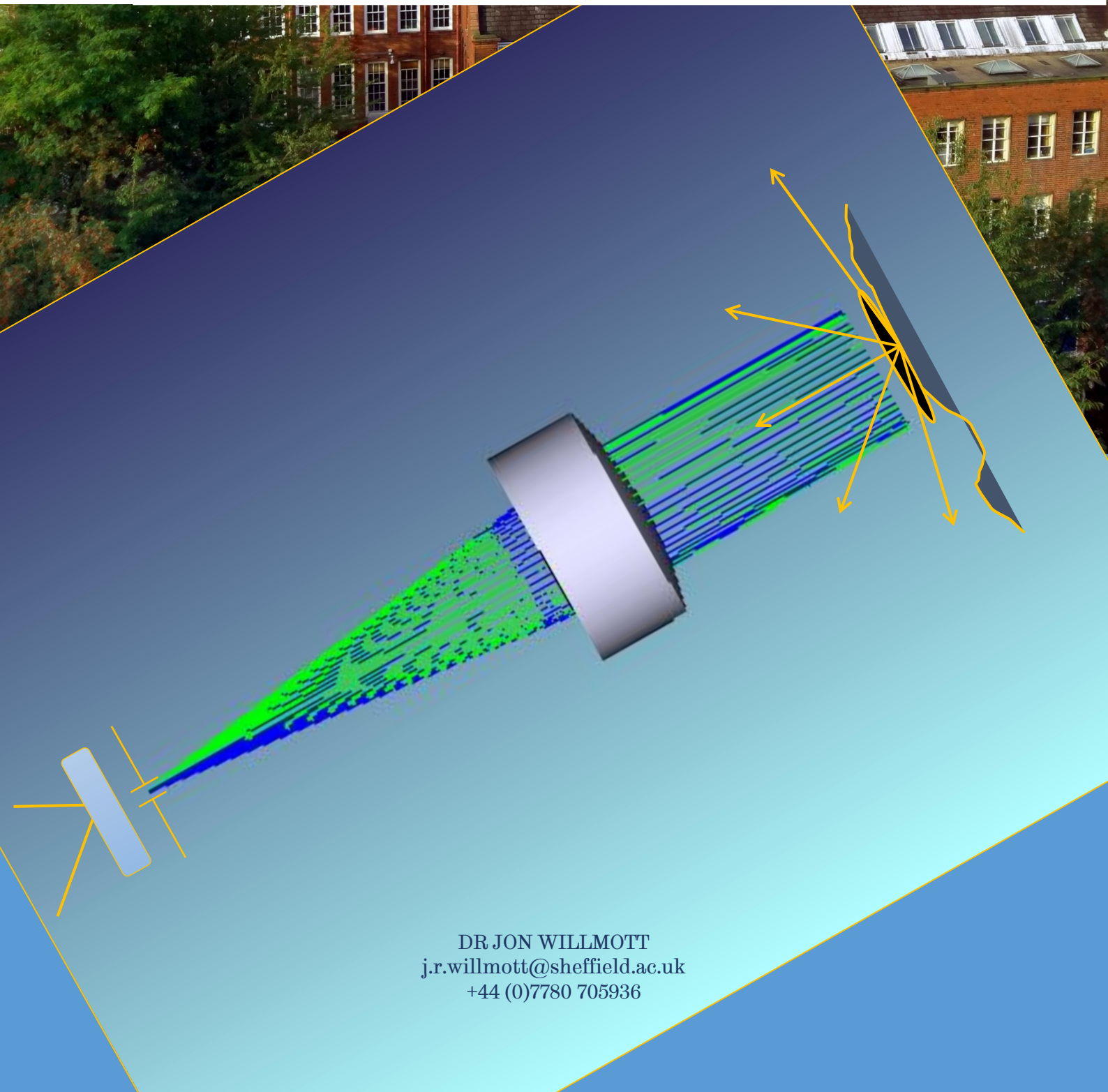


The
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Sensor Systems Research Group

Department of Electronic and Electrical Engineering



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Emissivity Measurement Capabilities

There is a parameter needed for every infrared temperature measurement: emissivity. This is the 'efficiency' with which an object radiates heat. Blackbodies emit with an emissivity = 1.0. We have spent many years studying, measuring and compensating for emissivity.

Experience

- Lab and field emissivity compensation
- Metrological emissivity measurements i.e. with uncertainty evaluation
- Freely radiating + emissivity independent measurements
- Gold cup measurements
- Two colour techniques
- Low emissivity algorithms

Research Capabilities

- Emissivity evaluation as a function parameters e.g. temperature, wavelength and atmosphere
- Emissivity compensation algorithm derivation
- New measurements

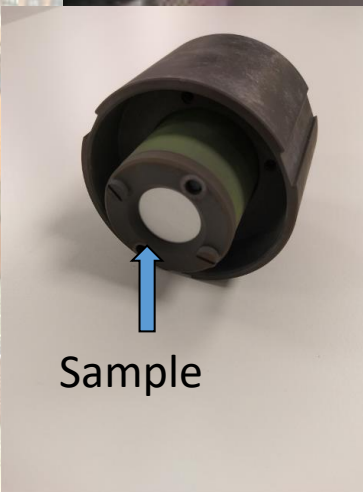
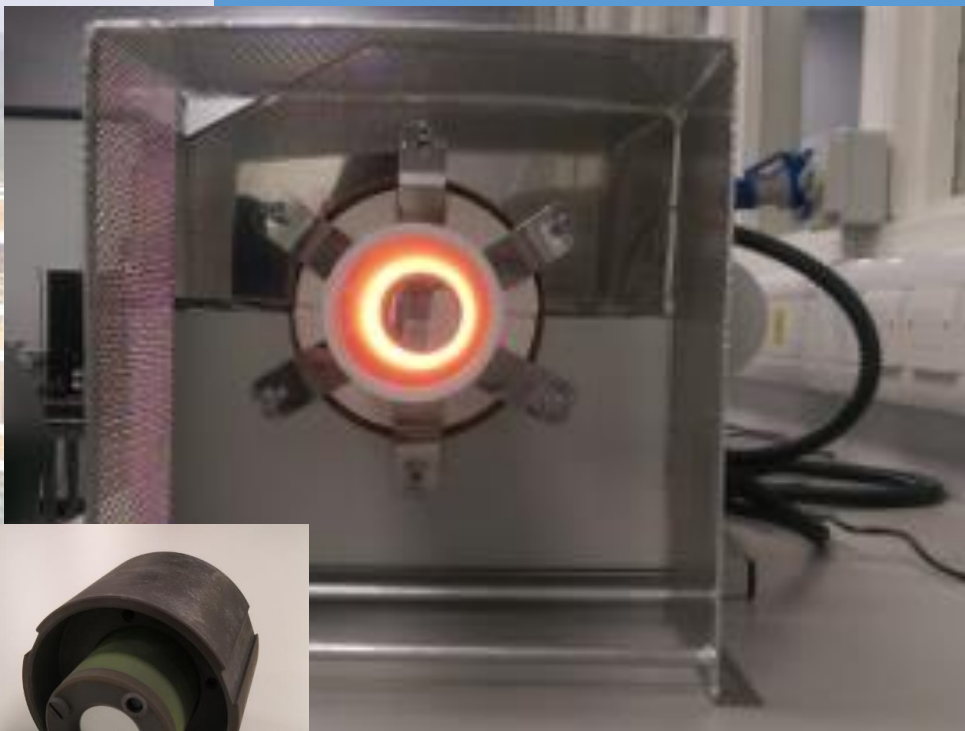
Engineering Capabilities

- Emissivity measuring instruments
- Gold cup thermometers
- Emissivity reference standard coatings
- Multi-wavelength infrared thermometers

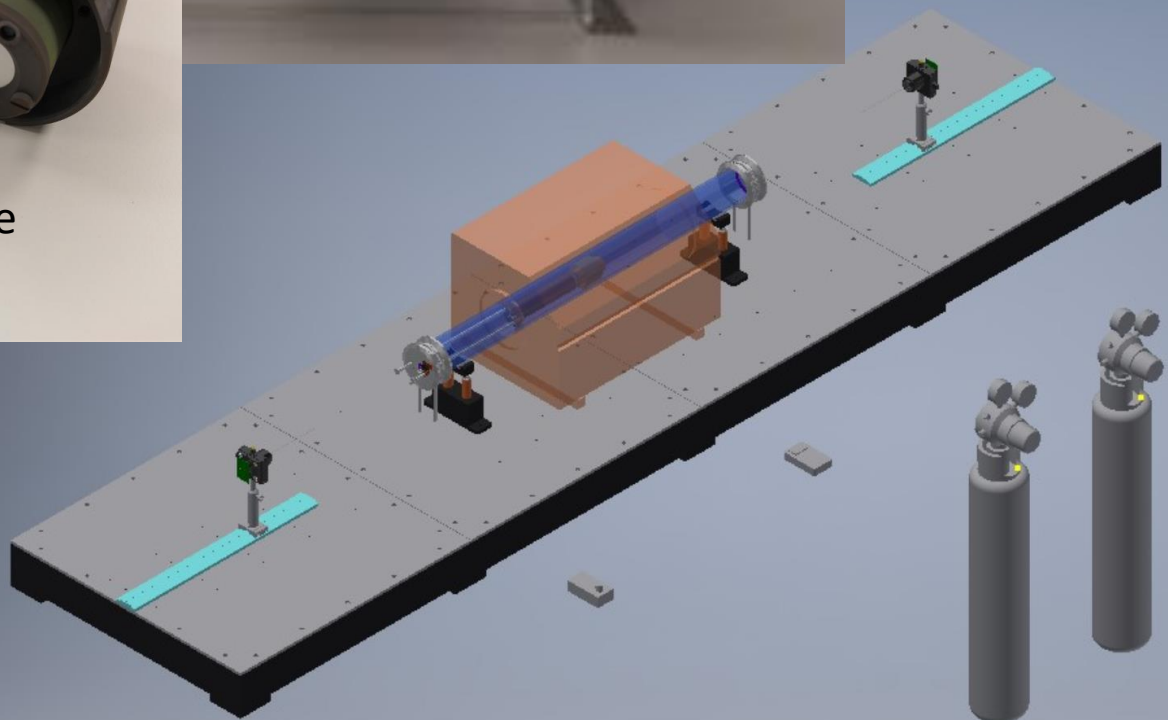
$$\varepsilon = \frac{S_{body}(\lambda, T)}{S_{blackbody}(\lambda, T)}$$

Measuring Emissivity

Our preferred method of measuring emissivity records samples radiating freely, with simultaneous measurements from a blackbody reference. These precise measurements are within a controlled environment and in thermal equilibrium.

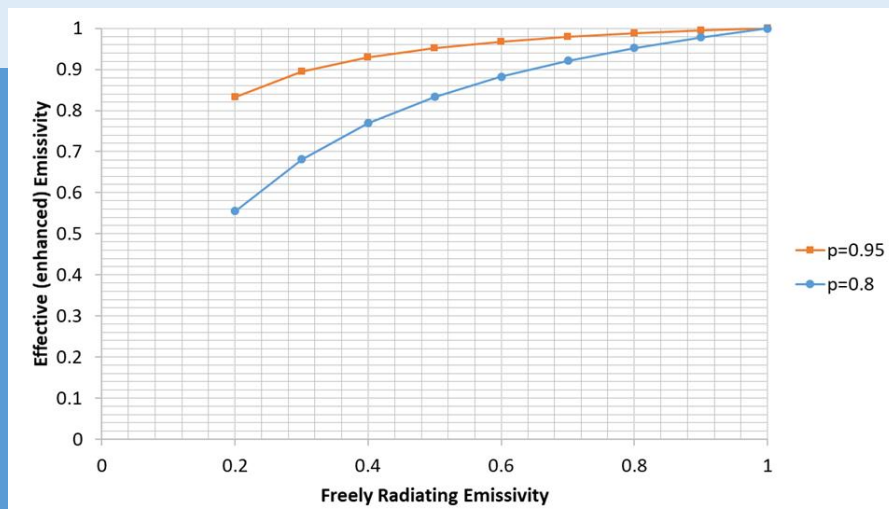


Sample

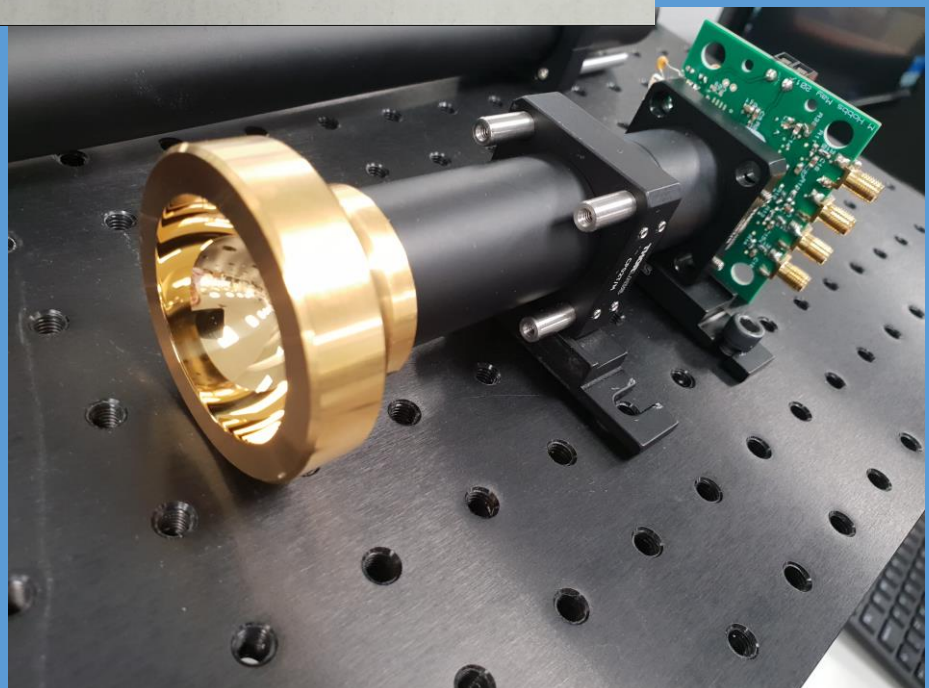
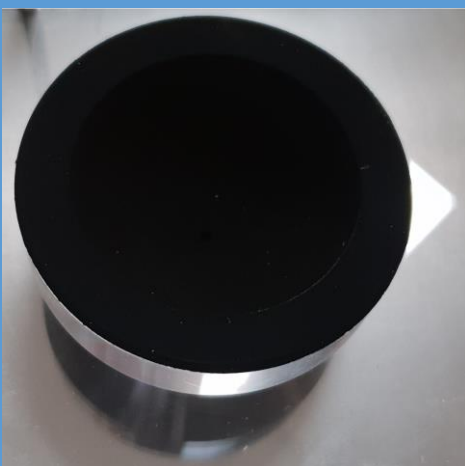


Gold Cup Infrared Thermometer

Gold cup thermometers measure the surface temperature of an object and enhance its emissivity to almost that of a blackbody. We design gold cup thermometers and also Vantablack cups that shield background radiation and are useful as references for gold cups.



$$\varepsilon_{\text{eff}} = \frac{\varepsilon}{1 - \rho_g(1 - \varepsilon)} = 1 - \frac{(1 - \rho_g)(1 - \varepsilon)}{1 - \rho_g(1 - \varepsilon)},$$

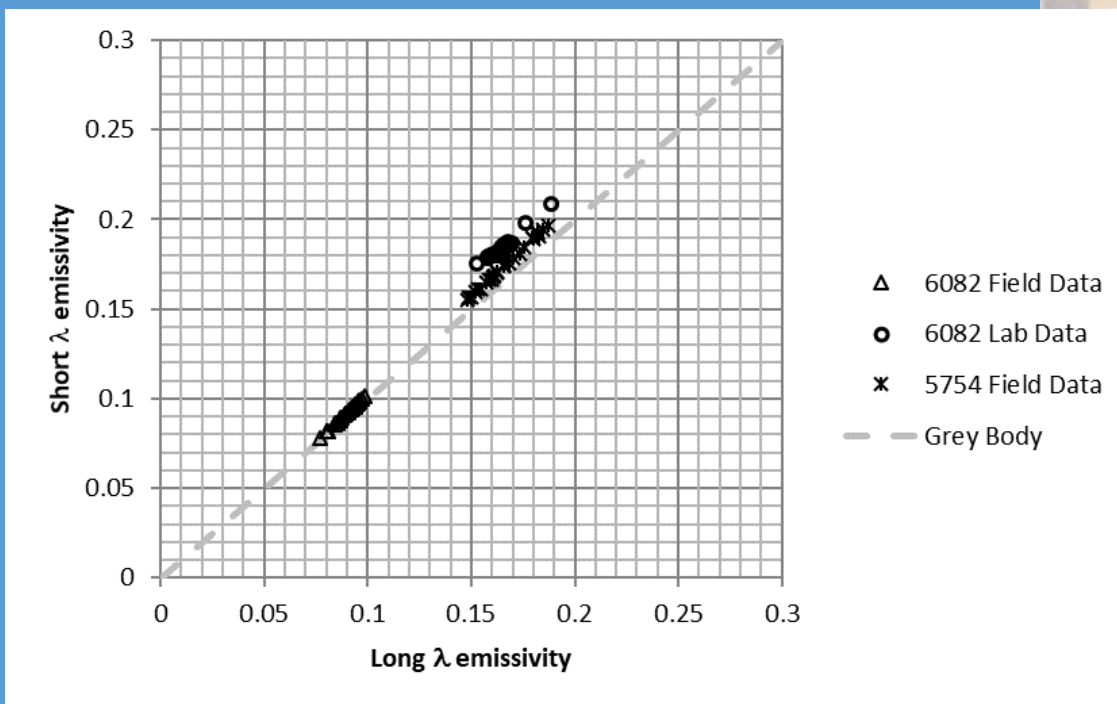


Emissivity Algorithms

Making careful measurements of emissivity allows us to use Wien's law and calculate emissivity compensation algorithms.

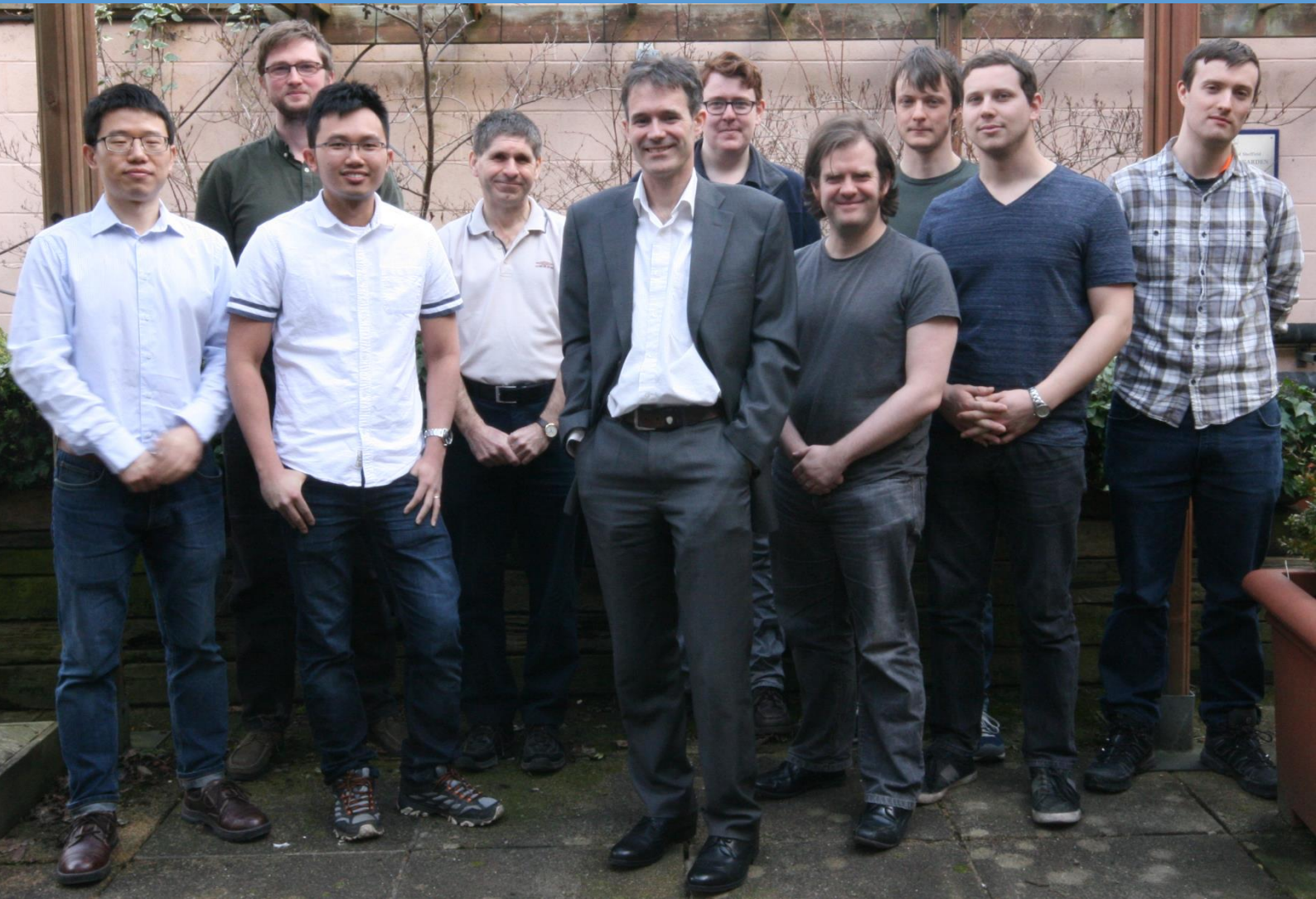
Algorithm Thermometer

$$\ln(\varepsilon_{\lambda_1}) = b \cdot \ln(\varepsilon_{\lambda_2}) + \ln a \quad \longrightarrow \quad S = \varepsilon \lambda^{-5} e^{\frac{-c_2}{\lambda T}} \quad \longrightarrow \quad \frac{1}{T} = A \left(\frac{1}{T_2} \right) + (1 - A) \left(\frac{1}{T_1} \right) + B$$



MEET THE TEAM

From left to right: Todd Zhu, Leigh Stanger, Cheong, Andy Heeley, Jon Willmott, Matt Davies, Matthew Hobbs, Nick Boone, Matt Grainger, Tom Rockett.



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