

Absolute Temperature Measurements Using Stimulated Brillouin Scattering in Gases

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Stimulated Brillouin scattering (SBS) has been widely applied in many photonic fields due to its high gain. However, SBS-based sensing, especially temperature sensing, faces several challenges. For example, in solid waveguides, accurate temperature measurements typically require pre-calibration due to variations in acoustic velocity, which arise from differences in optical guiding properties, inhomogeneous material density, and residual stress.

Here, we present an absolute SBS-based temperature sensing approach using gas-filled hollow-core waveguides, which effectively overcomes the limitations of solid-state systems. By replacing the solid gain medium with a gas, the Brillouin response becomes directly dependent on the acoustic properties of the gas, which can be accurately predicted using thermodynamic equations. This removes the need for fibre-specific calibration which is typically required in solid-core silica fibres. Additionally, both acoustic loss and temperature sensitivity improve consistently at lower temperatures, making this method particularly suitable for cryogenic environments. Under such conditions, the SBS gain and temperature sensitivity are significantly enhanced compared to ambient conditions, while the response remains fully predictable.



Short Bio:

Yuting Yang received the B.Sc. degree and the M.Sc. degree from the Peking University, China.

In 2021, she joined the Swiss Federal Institute of Technology of Lausanne (EPFL), Switzerland, as a Doctoral Research Assistant in GFO, supervised by Prof. Luc Thévenaz. Her main research interest is focused on distributed optical fibre sensing, especially based on Rayleigh

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