1. High resolution Brillouin light scattering

**Measurement of the sound velocity and the attenuation of elastic waves (LA, TA) in the GHz frequency range.**

\[ \nu_B = \frac{2}{\lambda_0} \text{sound velocity} \]

**High resolution and accuracy**

\[ \nu_B = \frac{2\Gamma}{\Delta \nu} \text{sound attenuation} \]

\[ \Delta \nu \rightarrow \text{linewidth resolution} \sim 15 \text{ Mhz} \]

**Internal friction**

\[ Q^{-1} = \Delta \Gamma \]

**The High Resolution Spectrometer**

- Plane Fabry-Perot (FFP)
  - Free spectral range (FSR) - 100 GHz
  - Calibrated by a reference beam produced by electro-optic modulation of the laser ray (\( \nu \pm \nu_i \))
  - \( \nu_i \) fixed at \( \nu_B \)

- Spherical Fabry-Perot (SFP)
  - FSR ~ 100 GHz
  - Calibration with the reference beam

**Serie 2**

- Density dependence of the measured Brillouin shift for silica \( \Delta \nu \rightarrow \text{expected thickness effect} \)

**Serie 1**

- Density dependence of the measured Brillouin shift for silica \( \Delta \nu \rightarrow \text{samples are not homogeneous in density} \)

**Density dependence of the measured Brillouin shift for silica**

- diamond anvil cell technique (DAC)
  - high pressure/high temperature in-situ experiments:
    - measurement of the sound velocity and the attenuation of elastic waves (LA, TA) in the GHz frequency range.
    - Brillouin frequency shift \( \nu_B \)
    - elastic constants
    - bulk modulus
    - poisson's ratio
    - spectral width
    - natural linewidth \( \Delta \Gamma \)

**Difficulties**

1. Finite size effects
2. Low signal luminosity improvement

**Prospective**

- in-situ characterization of densification in function of \( P \) and \( T \)

**Perspectives**

- in-situ characterization of densification in function of \( P \) and \( T \)

2. Permanently densified silica \( d-SiO_2 \)

Permanently densified silica \( d-SiO_2 \) is obtained by submitting short cylinders of \( v-SiO_2 \) to high pressure \( P \) (quasihydrostatic) at elevated temperature \( T \). Different densities were achieved by varying the duration of the treatment.

We studied two series of densified silica samples:

- **Heraeus Suprasil F300**; \( \leq 1 \text{ppm [OH]} \)
  - \( P \approx 8 \text{GPa}, T \approx 700 \degree C \)
  - \{ M. Arai, Tsukuba, Japan \}

- **Saint Gobain quartz IDD**; \( \leq 150 \text{ ppm [OH]} \)
  - \{ D. Vandembroucq, SGR-CNRS, Aubervilliers, France \}

**Density dependence of the measured Brillouin shift for silica**

- high constrast \( C \approx 10^2 \)

**Focusing spot**

- \( 100 \mu m \)

**Serie 2**

- Big sample from M. Arai \( \approx 1 \text{ cm}^3 \)
  - \( \Delta \nu = 2,55 \text{ g/cm}^3 \)
  - \( \rho = 2,60 \text{ g/cm}^3 \)

- SMALL sample from M. Arai
  - \( -2 \times 2 \times 4 \text{ mm} \)
  - \( \rho = 2,6 \text{g/cm}^3 \)

**Serie 3**

- Samples from D. Vandembroucq
  - \( 3 \text{ disks of } d-SiO_2 \) \( (2.59-2.61 \text{ g/cm}^3) \)
  - embedded in resin (\( \Phi \sim 3 \text{ mm} )

- samples are not homogeneous in density: we measured variations of density around 0.01 g/cm\(^3\) in each \( d-SiO_2 \) samples.