In collaboration with researchers from the Radboud University in Nijmegen we are studying the **mechanical properties of supramolecular hydrogel materials using advanced optical techniques**. These hydrogel materials, synthesized in Nijmegen, are **temperature-sensitive**, forming elastic gels at temperatures above ~18 Celsius; at lower temperatures they are liquid-like. These materials have recently been **predicted to exhibit unusual mechanical properties near the gelation temperature**. In particular, it is predicted that the frequency-dependence of the elastic shear modulus shows distinct variations near the gel transition. However, the high-frequency elastic response of these materials has not yet been studied experimentally.

**Project goals:**

The goal of the current project is to study this behavior in detail, using advanced optical measurements of the viscoelastic properties of these materials. Studying the mechanics of these materials in detail is important technologically as it is similar to that of biological tissues; these materials could thus find important uses in biomedical applications. Further, especially in light of the theoretically predicted unusual mechanical properties, their mechanics is also of profound scientific interest.

**Experimental tools:**

**Diffusing-Wave Spectroscopy (DWS):**

Diffusing-Wave Spectroscopy (DWS) **extends dynamic light scattering to the multiply scattering regime**, thereby enabling measurements of the motion of scattering particles in highly concentrated, turbid systems.\(^1\)

We have recently **extended the use of DWS measurements to cylindrical geometries**, enabling the use of standard dynamic light scattering instruments for these measurements.\(^2\)

**Microrheology**

To measure the mechanical properties of the hydrogels, we embed tracer particles within the hydrogel materials. The **precise dynamics of these tracer particles can then be measured using DWS**, and from the dynamics of the particles we can **calculate the viscoelastic properties of the material**. As DWS enables us to measure the dynamics of the particles with a time resolution of around \(10^{-8}\) s, the frequency-dependence of the elastic shear modulus can be studied at frequencies up to ~100 MHz.