

# Retrofit polarization-maintaining in optical fibers (PM)

## Apparatus and method for precisely maintaining the linear polarization of light at the output of an optical fiber

### Invention

The invention of the University of Bonn relates to the development of a method to retrofit polarization-maintaining (PM) optical fibers in a way, that a routinated achievement of polarization to a degree better than  $10^{-5}$  in extinction ratio takes place. Such a value is about two orders of magnitude better than what people in quantum optics and precision laboratories believe is achievable using commercial PM fibers.

The here described invention minimizes the polarization deviation of the light at the output of a polarization-maintaining (PM) optical fiber under disturbances of the environment such as temperature, pressure, and position changes. By alternately heating and cooling the fiber, the internal birefringence of the PM fiber is modulated within seconds by means of a heating element in the shell (see figure). In this way, the linear polarization at the fiber input can be adjusted with high precision, to ensure

Device for precisely adjusting the linear polarization in a polarization-maintaining optical fiber. The magnification shows the heating element, typically a metallic wire, located at least along a portion of the optical fiber within the fiber sheath.

that the polarization angle of the light at the fiber output remains highly stable up to a precision of  $0.01^\circ$  in spite of changes in the environmental conditions.

### Commercial Opportunities

The invention relates to a device, a method, and the use of the device in quantum optics, quantum information processing, precision physics, laser spectroscopy, laser interferometry, laser technology, or in atomic clocks, fiber-based data transmission, fiber-based quantum information transmission in quantum networks and/or fiber-based quantum sensors and / or classical sensors. By introducing a heating element into the fiber jacket, each PM fiber can be inexpensively upgraded in this way. Thus, the polarization at the fiber output can be rapidly modulated in situ, without interruptions and with minimal temperature excursion until the incoming polarization is precisely aligned onto one of the two major axes of the PM fiber.

- Whoever buys a PM fiber-optic patch cord aims at getting the best from it
- Technology can be directly integrated in the manufacturing process of the PM fibers
- Improved precision by one or two orders of magnitude compared to what a "person skilled in the art" typically can do
- Faster and less invasive adjustment of polarization into PM fiber-optic patch cords
- Low production costs: Estimated <1\$ per fiber-optic patch cord

### Current Status

A German patent application was filed. A laboratory-scale prototype was successfully manufactured, and laboratory tests performed. On behalf of the University of Bonn, PROVendis offers licenses to interested companies for the method.

An invention of University of Bonn.

### Competitive Advantages

- Directly integrated into the manufacturing process
- Low production costs
- Fast modulation of the birefringence of a PM fiber
- High-precision polarization preservation at the fiber output
- Affordable use on all PM fibers with a fiber sheath

### Technology Readiness Level

123456789

Experimental proof of concept

### Industries

- Physical Industry
- Quantum technology

### Ref. No.

5332

### Contact

Catherine Hartmann

E-Mail: [ha@provendis.info](mailto:ha@provendis.info)

Phone: +49(0)208-94105-46

