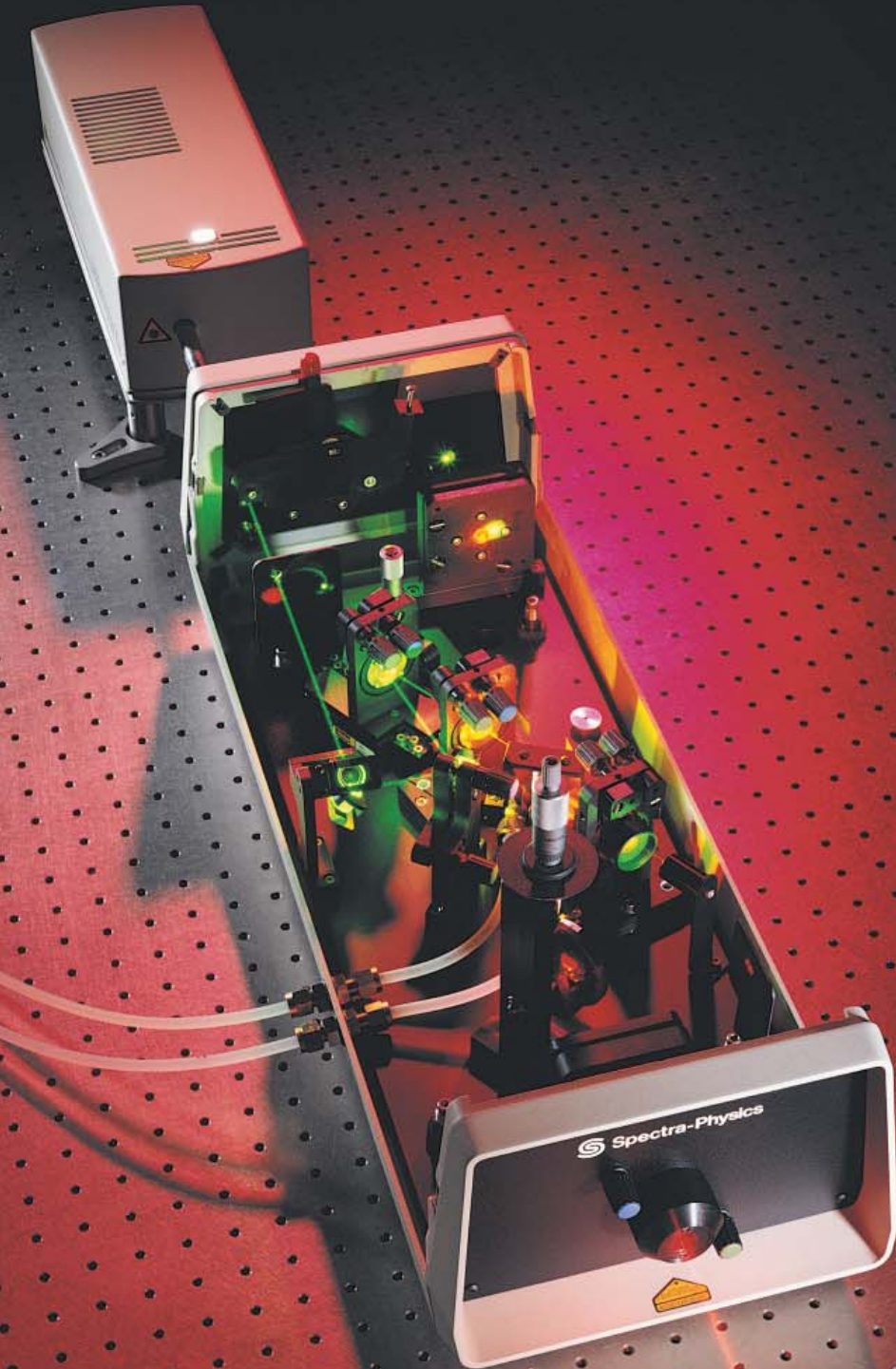


# 3900S

Tunable CW  
All Solid State  
Ti:sapphire Laser



 **Spectra-Physics**

The Solid State Laser Company™

# 3900S Titanium:Sapphire CW Laser

When it was introduced in the 1980s, the first generation 3900S laser was widely recognized as a major breakthrough in near-infrared laser technology, combining smoothly tunable CW output with solid-state reliability and simplicity. Thanks to advances in broadband optics, solid state visible pump lasers, and improved control systems, the updated 3900S has retained its clear leadership position in the market and sets new performance standards in a wide range of applications, including IR Raman spectroscopy, “optical tweezers,” photodynamic therapy, and spectroscopy of semiconductor materials.

## Ti:Sapphire Tunability

Titanium:sapphire is a remarkable laser material. Unlike many other types of laser gain media, Ti:sapphire will not degrade over time and does not need to be replaced during the useful life of the laser.

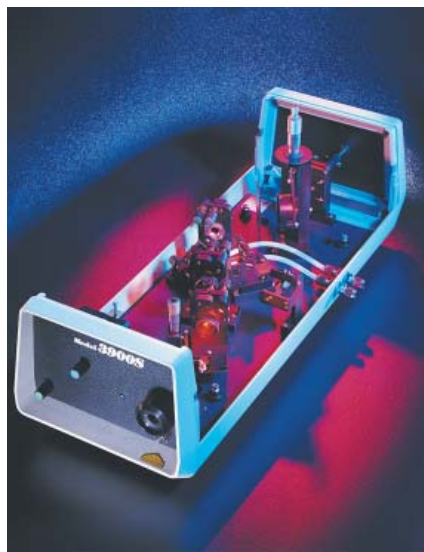
In addition, the Ti:sapphire gain medium offers a unique combination of advantages, including solid-state reliability, stability and broad tunability. Ti:sapphire is pumped with readily available green lasers; in fact, the 3900S laser can be pumped by the 532 nm output of the latest solid state Millennia® lasers. Smooth tuning throughout this wavelength range is achieved by rotation of a single micrometer control.

High gain and high damage thresholds are other important aspects of Ti:sapphire. Thanks to these characteristics, the output power of the 3900S is limited only by the power of the pump laser. In addition, the unique optical design of the 3900S allows you to change the pump laser power—for example, from 5 to 10 W of 532 nm radiation—without changing the Ti:sapphire

crystal or the cavity “pump geometry”, as is required with competing laser designs.

## Continuous Wavelength Tuning

The 3900S gives you truly continuous tuning from 700 to 1000 nm. Utilizing novel coating designs and new deposition technology, our optical team has developed a new generation of broadband optics, including mirrors and tunable



birefringent filter, now offered as a standard mirror set in the 3900S. As shown in the accompanying power tuning curves, a single set of these mirrors allows the laser to be tuned continuously from 700 to 1000 nm. In addition, the broadband birefringent filter tunes continuously without a “break” caused by a change in tuning order.

For users who wish to operate at the edges of the 3900S spectral range, we also offer extended blue and extended red mirrors sets to maximize the output power at these wavelengths.

## Simple Cavity—Simple Operation

With the 3900S, high performance does not come at the price of operational

### The 3900S Advantage.

- *Simple to use.* The 3900S uses a simple cavity design to provide ease of alignment and reliable output from 675 nm to 1100 nm.
- *Smooth Tuning.* The output can be tuned over hundreds of nanometers by rotating only one knob.
- *Broadband optics.* Wide tuning has been further simplified with the latest broadband optics. A single mirror set now covers the entire 700-1000 nm range.
- *High power output.* The efficiency of the 3900S translates into high output power for your application.
- *Variable linewidth.* For spectroscopy applications, the 40 GHz output linewidth can be narrowed to 15 GHz or even 1 GHz with simple to use optional etalons.

complexity. Indeed, one of the main reasons for the enduring popularity of the 3900S laser in a wide range of research disciplines is its remarkable simplicity and ease of use. The standing-wave cavity uses all reflective optics, whose focal lengths exhibit no wavelength dispersion. Unlike tunable cavities that utilize transmissive optics, there is no need to adjust the 3900S cavity as the laser wavelength is tuned.

The 3900S is also remarkably easy to set up and align—even by users with little experience with lasers. The 3900S uses four cavity mirrors in a horizontal Z configuration, since this ensures that no stray pump light escapes the cavity, greatly simplifying the visual alignment of the cavity emission.

## Stable TEM<sub>00</sub> Output

The 3900S produces a stable, high quality TEM<sub>00</sub> output beam with a

typical  $M^2$  value of less than 1.1, allowing the beam to be precisely collimated or focused to a near-diffraction limited spot. During normal operation, typical power fluctuations are less than  $\pm 1\%$  and the output beam is horizontally polarized with an extinction ratio of 100:1 or better.

For even greater stability, the laser cover can be sealed and the cavity purged with dry nitrogen. This purging also allows the laser to be tuned through the 980 nm spectral region with no slight power dips due to the well-known water absorption bands at this wavelength. An optional dry nitrogen purge box will provide you with cost savings by metering and filtering your nitrogen supply.

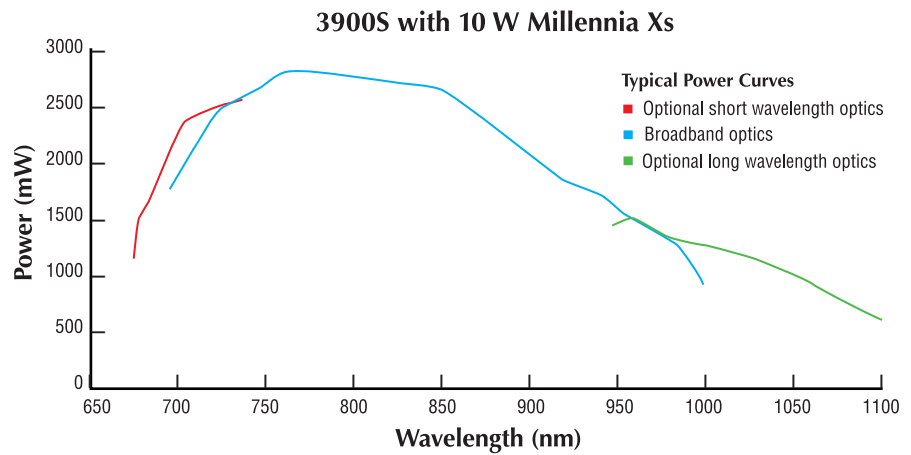
#### Variable Linewidth

In its simplest configuration, the wavelength of the 3900S is controlled by a single wavelength-sensitive element—the birefringent filter. The wavelength is tuned or set simply by adjusting the angle of this filter via a micrometer knob drive. In this standard configuration, the linewidth of the laser output is approximately 40 GHz.

Two etalons are standard options for the 3900S to support research in spectroscopy and other disciplines that require narrower linewidth. With a single (thin) etalon inserted in the cavity, the linewidth is 15 GHz, while a thick/thin etalon combination gets you below 1 GHz.

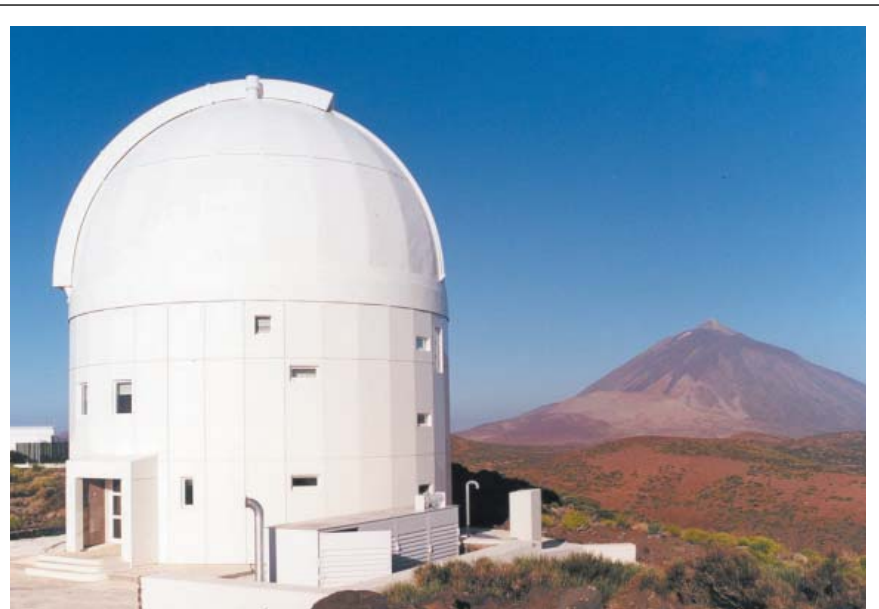
#### Vertical Integration

No matter how well a laser system is designed, it is only as good as its weakest part. That's why Spectra-Physics has always placed major emphasis on vertical integration. All the key components



of the 3900S are manufactured and tested in-house. Together with our state-of-the-art assembly/alignment methods and exhaustive QC programs, this vertical integration is your guarantee that every 3900S meets or exceeds every performance specification and will

provide years of reliable, maintenance-free operation. And should you ever have a problem with your 3900S, it will be promptly addressed and rectified by our worldwide service and support organization.



*The 3900S is being used by the European Space Agency in the Optical Ground Station (OGS) located at the Observatorio del Teide on the Canary Island of Tenerife. The OGS, managed by Dr. Zoran Sodnik and Dr. Angel Alonso, uses the tunable 3900S to study the influence of the atmosphere on laser beams used in space communication. The reasons for ESA's choice of the 3900S were its high power output while maintaining pointing accuracy.*

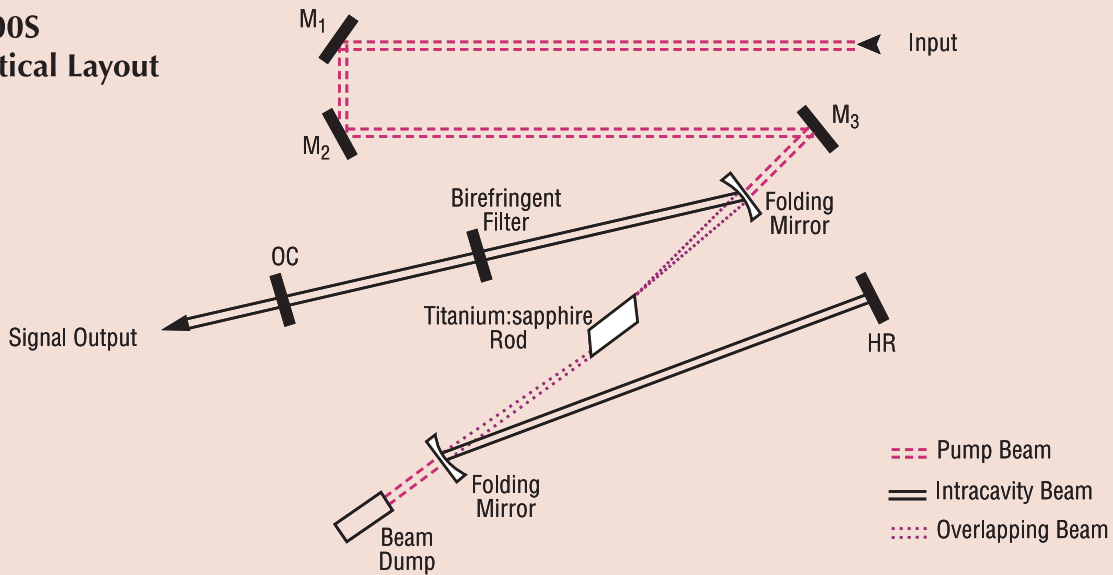
**Millennia—The Ultimate Pump Laser for the 3900S**

In 1996, Millennia was the first all-solid-state laser to provide high power CW visible output and immediately became the first choice for pumping Ti:sapphire lasers. Orders of magnitude more rugged and reliable than previous ion lasers, the Millennia is the best turn-key source of pump light

available today. The sealed cavity design needs no adjustment, and produces the ideal combination of excellent spatial mode (TEM<sub>00</sub>), beam pointing and ultra-low-noise output. With a choice of 5, 8 or 10 watts at 532 nm, this compact laser is ideal for the crowded environment typical of research labs, providing the smallest available footprint size.



**3900S Optical Layout**



The Solid State Laser Company™



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Printed in U.S.A. 1/03  
000B-0193S