



Dual Double-Wedge Pseudo-Depolarizer With Anamorphic PSF **Potential commercial applications include imaging spectrometers, radiometers, and polarimeters.**

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A polarized scene, which may occur at oblique illumination angles, creates a radiometric signal that varies as a function of viewing angle. One common optical component that is used to minimize such an effect is a polarization scrambler or depolarizer. As part of the CLARREO mission, the SOLARIS instrument project at Goddard Space Flight Center has developed a new class of polarization scramblers using a dual double-wedge pseudo-depolarizer that produces an anamorphic point spread function (PSF).

The SOLARIS instrument uses two Wollaston type scramblers in series, each with a distinct wedge angle, to image a pseudo-depolarized scene that is free of eigenstates. Since each wedge is distinct, the scrambler is able to produce an anamorphic PSF that maintains high spatial resolution in one dimension by

sacrificing the spatial resolution in the other dimension. This scrambler geometry is ideal for 1-D imagers, such as pushbroom slit spectrometers, which require high spectral resolution, high spatial resolution, and low sensitivity to polarized light. Moreover, the geometry is applicable to a wide range of scientific instruments that require both high SNR (signal-to-noise ratio) and low sensitivity to polarized scenes.

Classic polarization scramblers are built using birefringent glass that may be either air-spaced or optically contacted together. Examples of birefringent materials include quartz, magnesium fluoride, and calcite. Two popular design forms of polarization scramblers are the Lyot and Wollaston types. The Lyot type uses two plan parallel birefringent plates of different thicknesses to vary the polarization state as a function

of wavelength. Integrating the scene across a broad spectrum scrambles the polarized scene. This type reduces the spectral resolution of the scene. The Wollaston type uses two wedged birefringent plates to scramble the polarization state spatially. This type reduces the image quality of the scene. In addition to reducing the image quality of the scene, a single Wollaston scrambler is known to have polarized eigenstates and is ineffective at scrambling certain polarized scenes.

The SOLARIS instrument is designed to measure the solar radiation reflected from the Earth. The design furthers the state of the art in UV to near IR imaging spectroscopy.

This work was done by Peter Hill and Patrick Thompson of Goddard Space Flight Center. Further information is contained in a TSP (see page 1). GSC-16277-1

Cavitating Jet Method and System for Oxygenation of Liquids

Cavitation is considered to be more efficient in reclamation and re-use of water for space-based life support systems than sonochemistry.

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Reclamation and re-use of water is critical for space-based life support systems. A number of functions must be performed by any such system including removal of various contaminants and oxygenation. For long-duration space missions, this must be done with a compact, reliable system that requires little or no use of expendables and minimal power. DynaJets cavitating jets can oxidize selected organic compounds with much greater energy efficiency than ultrasonic devices typically used in sonochemistry. The focus of this work was to develop cavitating jets to simultaneously accomplish the functions of oxygenation and removal of contaminants of importance to space-structured water reclamation systems.

The innovation is a method to increase the concentration of dissolved oxygen or other gasses in a liquid. It uti-

lizes a particular form of novel cavitating jet operating at low to moderate pressures to achieve a high-efficiency means of transporting and mixing the gas into the liquid. When such a jet is utilized to simultaneously oxygenate the liquid and to oxidize organic compounds within the liquid, such as those in waste water, the rates of contaminant removal are increased.

The invention is directed toward an increase in the dissolved gas content of a liquid, in general, and the dissolved oxygen content of a liquid in particular. Liquid at moderate pressure is forced into a DynaSwirl swirl chamber in which a central vortex is formed that has a core pressure lower than the vapor pressure of the liquid, thus inducing cavitation in the vortex into which the desired gas(es) are drawn or

injected. The cavitation is then ejected from the nozzle through the exit orifice into a volume of liquid where the cavities break up and collapse. The large cavity surface area and violent mixing due to cavity collapse are believed to facilitate gas transport and dissolution into the liquid. These cavitation events have also been found to drive chemical reactions in a manner similar to that of ultrasonic sonochemistry, efficiently decomposing and destroying contaminating organic compounds. The reactions have been found to proceed more rapidly in the presence of air injection or oxygenation by this means.

This work was done by Georges L. Chahine of Dynaflow, Inc. for Johnson Space Center. Further information is contained in a TSP (see page 1). MSC-24019-1