Atom Beam Sources

Cold Atomic Beam System

Complete cold atomic beam sources for alkaline-earth precision experiments and atomic devices. Small chambers with patented permanent-magnet Zeeman slowers and in-vacuum 2D MOT optics allow high flux with low outgassing and no thermal beam flux at the cold atom port, which provides a CF-133 connection to customer vacuum chamber. Advanced thermal design of the effusion oven allows long-lifetime operation at minimal heating power, with no water cooling. An integrated low-outgassing hot window is provided for coupling of on-axis Zeeman cooling light. Ion and getter pumps integrated into the chamber manage outgassing from the oven at temperatures up to 600 °C. Operating baseline pressures below 1×10^{-11} Torr can be attained in the customer's downstream cold atom (typically 3D MOT) science chamber, with suitable pumping speed provided at the differentially-pumped cold beam output port.

Features

- **Cold atom flux > 10^{11} atoms/s at $T_\perp$ < 3 mK, axial speed ~40 m/s.**
- **Miniature chambers (1-2 L) and in-vacuum optics achieve baseline pressures < 10^{-10} Torr.**
- **Proprietary oven and Zeeman slower, hot window, and integrated transverse cooling/trapping.**
- **Hot beam flux is entirely blocked from entering the cold beam output port.**
- **Species available: strontium, calcium, or ytterbium.**

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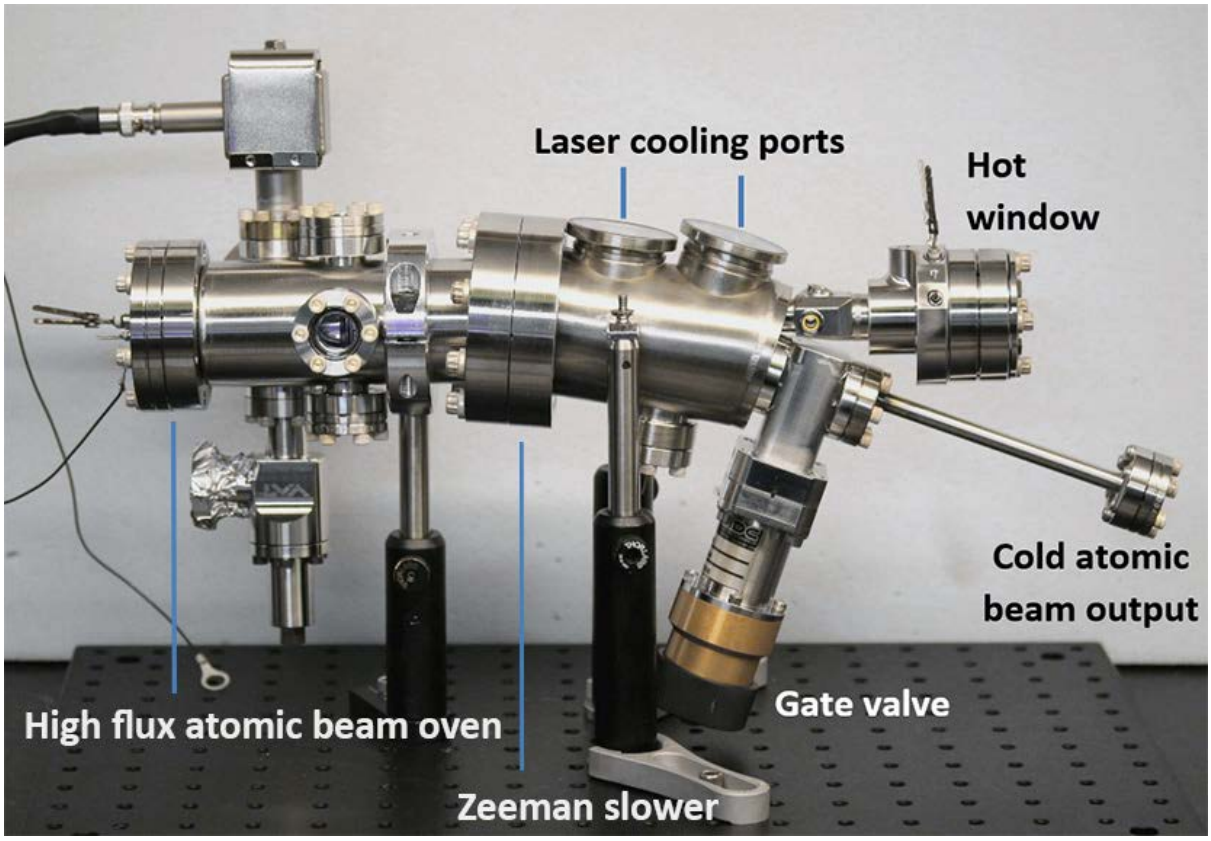
Specifications

Cold Atomic Beam System	
Cold atom flux	10^{11} atoms/s
Temperature transverse	$T_{\perp} < 3$ mK
Axial speed	~40 m/s
Atomic Beam Oven	
Strontium flux @ 420 °C	8×10^{13} atoms/s
Calcium flux @ 520 °C	4×10^{14} atoms/s
Ytterbium flux @ 420 °C	4×10^{14} atoms/s
Power consumption	10 W at 520 °C
Water cooling	none
Maximum temperature (tested)	650 °C
Approx. strontium lifetime at 420 °C	15000 h
Zeeman Slower	
Type	Sigma-minus standard
B-field generation	Permanent magnets
Magnetic shield	Integrated
Thermal shield	Integrated
Mounting	In-vacuum
Hot Window for Slower	
Maximum temperature (tested)	480 °C
Mounting	In-vacuum
Window material	Z-cut sapphire, AR coating
Clear aperture	8.5 mm diameter
Atomic Beam Chambers	
Windows	Welded, AR coated
Seals	ConFlat
Volume	2 L, complete system
Ion pump	2 L/s
Getter pumps	100 L/s and 5 L/s
Beam chamber baseline vacuum level (before pressure drop across the differentially-pumped output tube): • Oven and hot window off • 480 °C oven, 350 °C window – typical Sr operation	 ~1×10^{-10} Torr ~7×10^{-8} Torr
Connection to customer systems	UHV gate valve to differential pumping tube. CF 1.33 rotatable flange output. Larger output flange on request.

Sub-assemblies can be provided in off-the-shelf vacuum enclosures by request.
For more information, contact us at sales@aosense.com.

Product Details



High Flux Atomic Beam Oven

- Low power consumption.

Zeeman Slower

- Permanent magnet design (US Patent 8,710,428 B1).