

# LIQUID LENSES CREATED IN SPACE



## PUPIL INSTRUCTIONS SHEET

PROF. MORAN BERCOVICI AND HIS TEAM OF LAB RESEARCHERS: VALERI, MOR, AND OMER, HAVE DEVELOPED A METHOD TO PRODUCE EXCEPTIONAL QUALITY OPTICAL COMPONENTS (E.G. LENSES) USING LIQUIDS. THE LENSES ARE MADE OF POLYMER – A FLUID SUBSTANCE COMPOSED OF LARGE MOLECULES. WHEN THE SUBSTANCE IS EXPOSED TO ULTRAVIOLET (UV) RADIATION, IT STIMULATES A RAPID CHEMICAL PROCESS THAT CAUSES THE MOLECULES TO ATTACH TO EACH OTHER, AND THE LIQUID TO BECOME A SOLID. THE RESEARCHERS INJECT THE POLYMER INTO A RING PLACED INSIDE A CONTAINER FILLED WITH A SOLUTION OF WATER AND GLYCERIN. THE AMOUNT OF GLYCERIN IN THE WATER IS PLANNED SO THAT THE DENSITY OF THE SOLUTION IS COMPLETELY IDENTICAL TO THE DENSITY OF THE POLYMER. THIS ACHIEVES NEUTRAL BUOYANCY: THE POLYMER NEITHER SINKS TO THE BOTTOM NOR FLOATS TO THE SURFACE OF THE WATER. BUT THE POLYMER LIKES TO ADHERE TO THE INSIDE OF THE RING AND REMAINS ATTACHED TO IT. BECAUSE THE POLYMER AND THE SOLUTION ARE INSOLUBLE WITH EACH OTHER (THEY DON'T MIX, LIKE OIL AND WATER), A SMOOTH CONTACT SURFACE IS CREATED BETWEEN THE TWO LIQUIDS, WHICH IS CONTROLLED BY THE SURFACE TENSION. THIS CREATES THE SHAPE OF A PERFECT LENS!

NOW, ALL THAT'S NEEDED IS TO TURN THE LIQUID LENS INTO A SOLID ONE – AND THIS WAS DONE IN A LAB USING A UV LIGHT. THE LENS IS READY IN FIVE MINUTES. AT THIS STAGE, THE RING, WITH THE LENS INSIDE, IS REMOVED FROM THE WATER, AND THE LENS IS GENTLY PUSHED OUT OF THE RING.

USING THIS METHOD, THE RESEARCHERS ALSO MANAGED TO CREATE HUGE LENSES OR SQUARE LENSES. IN THE TRADITIONAL LENS INDUSTRY, A GREAT DEAL OF TIME AND MONEY WERE REQUIRED TO MAKE AND PERFECT SUCH LENSES.

A CALL FOR PROPOSALS BY THE ISRAEL SPACE AGENCY AND THE RAMON FOUNDATION INVITED ISRAELI SCIENTISTS TO SEND EXPERIMENTS FOR EYTAN STIBBE TO PERFORM WHILE IN SPACE ON THE RAKIA MISSION.

PROF. BERCOVICI AND HIS TEAM FELT THAT THEIR EXPERIMENT WAS PERFECT FOR SENDING TO SPACE, AS THE LENS-FORMING SOLUTION CREATES CONDITIONS SIMULATING MICROGRAVITY, JUST LIKE ON THE INTERNATIONAL SPACE STATION. THE TEAM MEMBERS WANT TO CREATE LIQUID LENSES IN SPACE AND TO USE THEM THERE.

NOW IS THE TIME TO PREPARE THE EXPERIMENT THAT EYTAN STIBBE, THE SECOND ISRAELI IN SPACE, WILL PERFORM AT THE INTERNATIONAL SPACE STATION. ALL THE DETAILS MUST BE PLANNED IN ORDER TO INCREASE ITS CHANCES OF SUCCESS, AND OF COURSE IT'S IMPORTANT TO ENSURE SAFETY SO THAT THE EXPERIMENT DOES NOT ENDANGER THE ASTRONAUTS OR THE FUNCTIONING OF THE SPACE STATION.

**IN GROUPS, CONDUCT A DISCUSSION ABOUT THE EXPERIMENT TO BE SENT TO SPACE. YOU HAVE 20 MINUTES TO DISCUSS THIS, AFTER WHICH YOU WILL PRESENT YOUR FINDINGS TO THE OTHER GROUPS.**

WHAT ELEMENTS OF THE EXPERIMENT ON EARTH WON'T CHANGE WHEN THE EXPERIMENT IS CONDUCTED IN SPACE?

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WHAT ELEMENTS OF THE EXPERIMENT NEED TO BE CHANGED IN ORDER TO CONDUCT THE EXPERIMENT IN SPACE? DOES ANYTHING NEED TO BE ADDED? DOES ANYTHING NEED TO BE REMOVED? WHAT SHOULD BE GIVEN MORE ATTENTION, AND WHAT PERHAPS LESS?

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WHAT SAFETY PRECAUTIONS SHOULD BE TAKEN WHEN THE EXPERIMENT IS CONDUCTED IN SPACE?

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