Light-Pressure Device (LPD)

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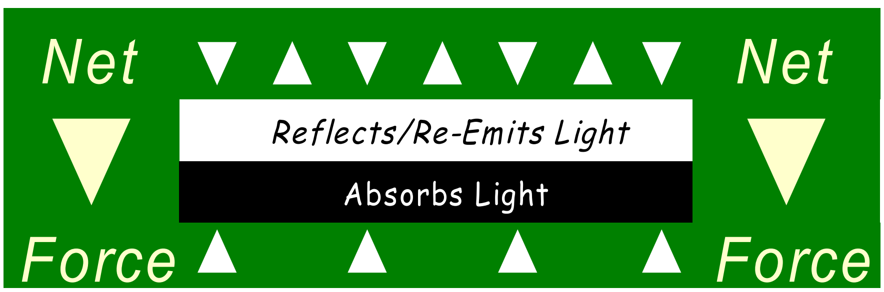
For the purposes of this paper, the term *light* shall encompass any part of the real or virtual electromagnetic spectrums. LPDs will produce a motive force in Micro Electro-Mechanical Systems (MEMS) and in any other device where light-pressure is sufficient to serve as the primary motive-force. Like Nichols Radiometer, LPD experiences a ***net*** light-pressure because it primarily absorbs light on one side, but primarily reflects and/or re-emits light on the opposite side. Unlike Nichols Radiometer, LPD operates primarily in a preferred range of the virtual photon spectrum and can be operated when and wherever virtual photons are available in the incident photon spectrum, regardless of how much of the real photon spectrum is present.

In the illustration below, the green field represents empty Space. The black band represents the material and/or texture on its one side that *primarily* **absorbs** virtual photons. The white band represents the material and/or texture that *primarily* **reflects and/or re-emits** virtual photons. The ***white*** arrows represent the virtual photons that are interacting with the black and white sides of the device.



On the one hand, note how the white arrows show photons going into the black absorptive side *and not coming out again.* On the other hand, note how the white side reflects and/or re-emits *most* of the photons that are hitting it. The light-pressure that is pushing toward the white reflective/re-emitive side is *greater* than the light-pressure that is pressing on the opposite direction, on the black, absorbent side. The *two* pale yellow arrows on either side of the device indicate the *direction* of the ***net*** light-pressure force that is pushing downward on the entire device.

The optimal operating spectrum is a compromise between two primary considerations: On the one hand, especially-energetic, smaller wavelengths are ***too-***small *if* they pass through or will not reflect and/or re-emit from practical material arrangements*;* on the other hand, wavelengths that are too *large* are considerably less energetic. Unlike LPD, *Nichols Radiometer* does ***not*** experience a significant *net* light-pressure from the virtual photon spectrum because it absorbs ***and*** reflects ***and*** re-emits the optimum virtual photon wavelengths **equally-well** *on* ***both*** *sides.* In contrast, the LPD (pictured above) is made with materials and textures that primarily *absorb* the *optimal* part of the virtual photon spectrum into its one side while at the same time, it *primarily* reflects and/or re-emits the *optimal* part of the virtual photon spectrum from its *other* side.

The Mixed Chart, below on the left, is in nm, PSI, & PSF. The SI Chart on the right is in nm & Pascal. The calculations assume that one side perfectly absorbs all photons that are in a given target range; it also assumes that all photons in the specified range are perfectly reflected or re-emitted at the same range of wavelengths by the opposite side; therefore, we are assuming the quantum pressure on one side of QPD is 50% of the pressure on the other side. The charts list the *net* quantum-pressures that include the listed wavelength in nanometers AND *every* **larger** wavelength.

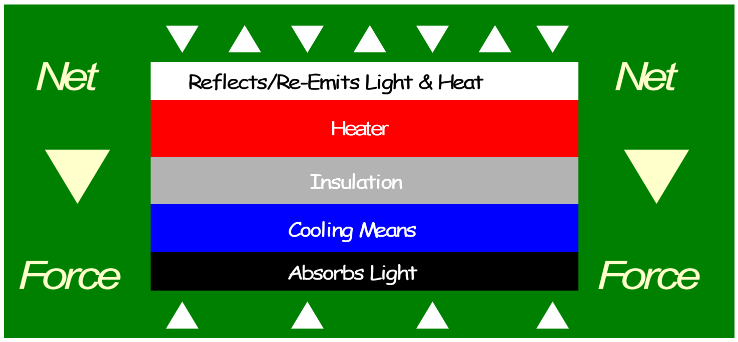
To determine the *ideal* net pressure on a QPD that operates in a particular range, subtract the smaller pressure value from the larger pressure value. For example, take the range that includes 4 nm to 8 nm. At 4 nm the pressure for all wavelengths that are greater than or equal to 4 nm is 374 psi, but at 8 nm the pressure for all wavelengths that are greater than or equal to 8 nm is only 23 psi; therefore, we subtract 23 psi from 374 psi to obtain the ideal pressure of a QPD that operates perfectly within this range, 351 psi. (Of course real materials are *unlikely* to match up so perfectly.)

nm	PSI	nm	PSI	nm	PSF	nm	PSF
1	95,838	14	2.5	27	41.6	40	7.4
2	5,990	15	1.9	28	35.3	41	6.6
3	1,183	16	1.5	29	30.2	42	6.0
4	374	17	2.5	30	26.0	43	5.4
5	153	18	1.9	31	22.5	44	4.9
6	74	19	1.5	32	19.5	45	4.4
7	40	20	1.1	33	17.0	46	4.0
8	23	21	0.9	34	14.9	47	2.8
9	15	22	0.7	35	13.2	48	2.6
10	10	23	0.6	36	11.6	49	2.4
11	7	24	0.5	37	10.3	50	2.2
12	5	25	0.4	38	9.2	51	2.0
13	3	26	0.3	39	8.2	52	1.9

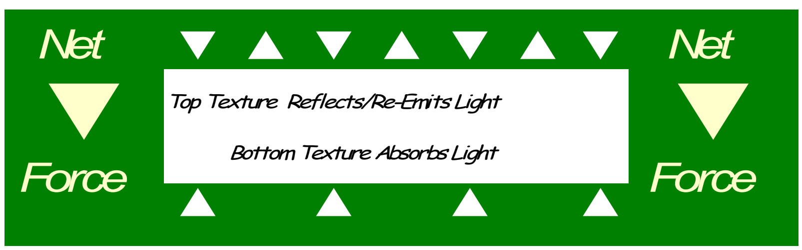
nm	Pa	nm	Pa	nm	Pa	nm	Pa
1	650,000,000	14	16,920	27	1,223	40	254
2	40,625,000	15	12,840	28	1,058	41	230
3	8,024,691	16	9,918	29	919	42	209
4	2,539,063	17	7,782	30	802	43	190
5	1,040,000	18	6,192	31	704	44	173
6	501,543	19	4,988	32	620	45	159
7	270,721	20	4,063	33	548	46	145
8	158,691	21	3,342	34	486	47	133
9	99,070	22	2,775	35	433	48	122
10	65,000	23	2,323	36	387	49	113
11	44,396	24	1,959	37	347	50	104
12	31,346	25	1,664	38	312	51	96
13	22,758	26	1,422	39	281	52	89

In some cases it is desirable to keep the reflective/emissive side as hot as is practical and/or the absorptive side as cold as is practical. Sometimes this translates into simply allowing natural heat conduction between the two sides of the device. In other instances, heat-*conduction* can be actively promoted by incorporating heat pipe(s) or a Peltier device inbetween the two sides. The method of heat conduction is represented in the LPD, as depicted in the following illustration, by the color Red.

In other instances it is desirable to ***actively*** heat the reflective/emissive side using electrical, chemical, radiant energy or other method to *raise* its Black-Body-Radiation to *reflect/re-emit* more energetic wavelengths. In one embodiment, we can use high-temperature plasmas as the reflective/emissive “surface.” In some applications, it is desirable to *actively* cool the absorptive side as much as is practical, using various methods or combinations of methods such as refrigeration, thermo-acoustic effects, cooling gases or fluids, heat pipes and/or thermo-electromagnetic stimulation of a thin, surrounding layer of ionized gas. In this case we want to alter the Black-Body-Radiation Characteristics of the absorptive side to emit longer, less-energetic wavelengths and to reduce reflection. Of course, we sometimes need insulation between the two competing processes, as depicted by the gray band, below.



Proper textures can be combined *along* with various combinations of *different* materials to achieve the same basic results. Alternatively, as shown below, a single material with two textures, a light absorbing texture on one side and a reflective/emissive texture on the other side can be used as the two opposite surfaces. One advantage of this arrangement is that the reflective/emissive side can easily dissipate the heat that is generated in the absorptive side since both can be made of metal.



To approximate an optimal Black Body Radiator, useful textures can take the form of many materials, especially ones having pores in the low nm range. The *sorts* of methods used to produce porous metallic catalysts that are similar to Raney Nickel appear especially promising; these porous materials are generally made by alloying two or more materials together such as, in the case of Raney Nickel, aluminum and nickel. The solid pieces of the precursor alloy are *normally* ground to a fine powder and treated with a solution that leaches out much of the aluminum, leaving a powder whose particles are *highly* porous with *very* tiny holes (on the order of a few nm and even less.) In some cases, a suitable catalytic porous powder can simply be applied to the absorptive surface. In other cases it will be more effective to simply leach *one* side of the solid alloy; then treat the reflective/emissive side to enhance *its* ability to reflect and/or re-emit light in the virtual photon optimum spectrum. As one example of many, that side can be fashioned into a high-quality mirrored surface.

Other methods include pitting surfaces or applying coatings that provide a good approximation of a black body radiator: Graphite, lamp black, various families of nano-tubes and fullerenes and their derivatives are particularly attractive for these purposes.

For the reflective/emissive side, materials that fluoresce in the optimal virtual photon spectrum, or otherwise provide a wide spectrum of wavelengths that are reflected, re-emitted and *not* absorbed will be used! Different optically-tailored organic polymers are excellent materials for both sides of the LPD. Within the scope of this invention, I am including the notion of ferro-electric polymers in conjunction with other embedded optical elements, which include but are not limited to optically active polarizing dispersions embedded into the polymer. A similar approach can be taken with similarly tailored glasses, and ceramics.

Finally, nanometer-sized cavities are thought to have relativistic properties wherein, entrained processes *(and light)* experience an accelerated reaction time wherein, molecular processes occur faster in these cavities (hence the catalytic properties that are associated with them.) Lower wavelengths are up-shifted to higher wavelengths inside the cavities (from our perspective.) Therefore, in some applications the reflective-emissive side will be nano-porous or otherwise filled with nanoscopic cavities that are engineered to use these Relativistic effects to cause a "blue-shifted flux-pressure on the "floors" inside the cavities. Again, this will result in a net light pressure.

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