激光行业翻译中文🡪英文Chinese-English Translation of Common Laser Knowledge

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| 常见激光知识总结(持续更新…) Summary of Common Laser Knowledge (to be continuously updated) |
| [各种波长（颜色）手持激光的特点简介](http://www.coolplaybar.com/thread-27-1-1.html)  Introduction to the characteristics of hand-held lasers of various wavelengths (colors)  经常有激光爱好者问某种波长的激光和另一种比怎么样  Some laser lovers often ask me which one is better between two lasers of different wavelengths  这里把手持的各种波长激光特点都介绍一下  Here I would like to introduce the characteristics of hand-held lasers of various wavelengths  按照短波到长波排列  according to the order from short wave to long wave |
| 个人的推荐Personal Recommendation 喜欢光束亮骚但是不烧东西的 400mw左右的532nm 这个功率已经很亮 1000mw不会有比这个亮非常多的感觉  For those who like showing off the light beam but don't want to burn things, I recommend laser 400MW 532nm, it is very bright and you won't feel 1000mW laser will be much brighter than this.  喜欢烧东西又偶尔亮骚的 1.6W的445nm 近距离烧很给力光束也不错的  For those who like to burn things and show off the light beam once in a while, I recommend laser 1.6W 445nm, it is awesome to burn things up close.  喜欢远距离烧东西的 500mw, 405nm 10米轻松点火柴绝对很好用  For those who like to burn things from a distance, I recommend laser 500MW 405nm, this is absolutely good for lighting matches within 10 meters with ease. |
| [激光安全分级](http://www.coolplaybar.com/thread-275-1-1.html)  Laser Safety Classification  根据激光对人体的危险度分类，在光束内观察对眼睛的MPE（maximal possible effect最大可能的影响）做基准，可分为一到四级。激光产品厂商应该把Class II, III 和 IV的警示标签贴到相应的激光产品上。  According to its risk level to human body, with MPE (maximal possible effect) of light beam to eyes as a standard, it can be divided into Class I, II, III and IV. Laser product makers should stick the warning label with laser safety classification on the corresponding laser products.  Class I：低输出激光（功率小于0.4mW），不论何种条件下对眼睛和皮肤，都不会超过MPE值，甚至通过光学系统聚焦后也不会超过MPE值。可以保证设计上的安全，不必特别管理。典型应用如CD播放机，CD-ROM设备，地质勘探设备和实验室分析仪器等。  Class I: low output laser (power < 0.4mW), the risk to human eyes and skin will not exceed MPE value under any conditions, even after focusing ion beam through optical system. The design safety can be guaranteed, no need special management. Typically used in CD players, CD-ROM equipment, geological prospecting equipment and laboratory analytical instruments etc..  Class II：低输出的可视激光（功率0.4mW-1mW），人闭合眼睛的反应时间为0.25秒，用这段时间算出的曝光量不可以超过MPE值。通常1mW以下的激光，会导致晕眩无法思考，用闭合眼睛来保护，不能说完全安全，不要直接在光束内观察，也不要用Class II激光直接照射别人的眼睛，避免用远望设备观察Class II激光。典型应用如课堂演示，激光教鞭，瞄准设备和测距仪等。  Class II: low output visible laser (power 0.4mW-1mW), the reaction time of keeping eyes closed is 0.25S, light exposure calculated in this period should not more than MPE value. Usually the laser below 1mW can cause dizziness and make you unable to think, so you close your eyes to protect them, which is not totally safe. Don't observe things directly in the beam, don't light directly to others eyes with Class II laser and avoid the observation of Class II laser with telescope or the like. Typically used in classroom demonstration, laser pointer, pointing devices and distance measuring instruments etc..  Class III：中输出激光，光束若直接射入眼睛，会产生伤害，基于某些安全的理由，进一步分为IIIA和IIIB级。  Class III: mid output laser, if the beam shines directly into eyes, it will hurt the eyes, for some safety reasons, it is further divided into Class IIIA and Class and IIIB.  IIIA级为可见光的连续激光，输出为1-5mW的激光束，光束的能量密度不要超过25W/m﹣m，避免用远望设备观察IIIA激光，这样可能增大危险。IIIA的典型应用和Class II级有很多相同之处，如激光教鞭，激光扫描仪等。  Class IIIA: the continuous laser of visible light, with a output laser beam of 1-5mW, the beam energy density should not be more than 25W/m﹣m, avoid the observation of Class IIIA laser with the telescope and the like, or it may increase the risk. There are lots of similarities of typical applications of Class IIIA and Class II, such as laser pointer and laser scanner etc..  III B 级为5-500mW的连续激光，直接在光束内观察有危险。但最小照射距离为13cm，最大照射时间十秒以下为安全。IIIB激光的典型应用如光谱测定和娱乐灯光表演等。  Class III B: the continuous laser of 5-500mW light, which will cause danger if directly observing things in the beam. However, it is safe with the min. exposure distance of 13cm and max. exposure time of 10S. Class IIIB laser is typically applied in spectrometry and light entertainment etc..  Class IV：高输出连续激光（大于500mW），高过第三级，有火灾的危险，扩散反射也有危险。典型应用如外科手术，研究，切割，焊接和显微机械加工等。  Class IV: high output continuous laser (>500mW), it is higher than the Class III, which will cause fire, and its scattered reflection is also dangerous. Typically applied in surgical operation, research, cutting, welding and micro machining etc..  激光处理上的安全对策：像一般家庭或办公室激光唱盘或激光打印机等的应用机器，为激光光不会射出外部的构造形成，能够保证安全。另外一些激光光若不发出外部不会有机能的装置。如有这样的情形就须参考下述对策。  Safety measures on laser processing: it can ensure safety for some general household or office laser discs or laser printer or other applied machines, as the laser light will not go out to the external construction. In addition, functional device wouldn't be provided to some lasers that the light won't go out. If it happens, please refer to the following countermeasures.  （1）根据激光装置的级别，有关激光伤害的安全或伤害具有充分的知识与认识的人来指导处理。  (1) According to the level of laser devices, specialized personnel who have a sufficient knowledge and understanding of laser safety or hazard should guide in the laser treatment.  （2）三级以上的激光制作由有安全操作适当教育的人来执行。  (2) Personnel producing lasers above Class III shall be competent on the basis of appropriate education of safe operation.  （3）动作中的激光装置，假如不发出激光光，也不要探视光路中。  (3) Don't view the light path directly if laser devices in action don't emit laser light, （4）激光共振器的调整，光轴调低时，会突然发射激光。要经常注意眼睛的位置来处理。  (4) When turning down the optical axis during the adjustment of laser resonator, the laser light will emit suddenly, so please always pay attention to the eye position when handling.  （5）CO2激光使用眼睛看不到的红外光大型激光时，附近的人要特别注意。  (5) If infrared light invisible to the eyes is adopted for large CO2 laser, people nearby should pay special attention to it.  （6）不能避免反射光或乱射光时，在使用三级以上的激光时，可以使用保护眼镜。  (6) If reflected light or pot shoot light cannot be avoided, users can wear protective glasses when using lasers above Class III. |
| [激光发散角计算方法](http://www.coolplaybar.com/thread-42-1-1.html)Calculation method of laser divergence angle  首先把激光调节到平行光 测量远处光斑和出光光斑  Firstly, adjust the laser light to parallel light  to measure distant light spot and light spot at aperture  发散角=2arctan（（光斑直径－出光直径）÷2÷距离）×1000 单位全是毫米  Divergence angle =2arctan ((spot diameter- beam diameter at aperture) / 2 / distance) \* 1000  All units are mm  如果嫌麻烦请用简便公式 （光斑直径（毫米）－出光直径（毫米））÷距离（米）  For convenience's sake, you can use the following simple formula  (spot diameter (mm) - beam diameter at aperture (mm))/ distance (m)  注意上面公式是弧度制的运算结果单位mrad 如果用角度运算结果请×π/180  Note: the above formula adopts the radian calculation result, the unit is mrad, if using the angle calculation result, please take ×π/180 as the unit  如果是445nm 因为光斑都是长方形且⊥方向发散大所以出光直径是测量出光光斑的短边而光斑直径是测量长边 635nm也一样  If it is 445nm laser, as all spots are rectangular and have big divergence in ⊥ direction, the beam diameter at aperture is the short side to measure spots at aperture while the beam diameter at aperture is the long side, the same for 635nm laser |
| [【科普】激光的模式](http://www.coolplaybar.com/thread-684-1-1.html)  [Science] Laser mode  激光束横截面上光强的分布情况称为激光横模。一般笼统地把横模当作激光模式。用符号TEMmn表示各种横向模式。TEM表示横向电磁波，m、n均为正整数，分别表示在x轴和y轴方向上光强为零的那些点的序数，称为模式序数。下图示出了几种不同的激光束横模的光斑。TEM00模又称基模，其光斑中任何一点光强都不为零。若光斑在x方向上有一点光强为零，称为TEM10模；在y方向上有一点光强为零，称为TEM01模。以此类推，模式序数m和n越大，光斑中光强为零的点的数目越多。有不同横向模式的激光束称为多模。  The distribution of light intensity on cross section of laser beam is called laser transverse mode. The transverse mode is generally regarded as the laser mode. TEMmn is used to present transverse mode. TEM means transverse electromagnetic wave, both m and n are positive integers, respectively standing for ordinal numbers of the points with zero light intensity on x axis and y axis, called mode ordinal number. The diagram below shows light spots of several different laser beam transverse modes. TEM00 mode is also called as the basic mode, the light intensity of any point in its spot will not be zero. If there is a light intensity of any point in spot on x axis is zero, it is called as TEM10 mode; If a light intensity of any point in spot on y axis is zero, TEM01 mode, and so on, mode ordinal numbers m and n are larger, there are more points with zero light intensity in spots. Laser beam with different transverse modes is called as multimode. |
| [胶合晶体光胶晶体分离晶体](http://www.coolplaybar.com/thread-54-1-1.html)  Bonding crystal, optical cement crystal, separated crystal  先介绍下532nm激光的原理  First introduce the principle of 532nm laser 泵浦源 808nm的半导体激光管（LD）给激光晶体供能  808nm semiconductor laser diode (LD) of pumping source supplies energy to laser crystal 晶体大部分是Nd:YVO4 也有是Nd:YAG 工作离子都是Nd3+ 产生1064nm红外激光  Most of crystals are Nd:YVO4, some are Nd:YAG, both have Nd3+ ions and can produce 1064nm infrared laser 红外激光经过KTP非线性倍频晶体变成532nm的绿光  Infrared laser turns into 532nm green light through KTP nonlinear frequency doubling crystal  所以 532nm有2个晶体激光晶体倍频晶体这2个晶体的组合方式就有胶合光胶分离  So, 532nm has 2 crystals, including laser crystals and frequency doubling crystal, the combination method of these two crystals include bonding, optical cement and separation.  胶合晶体采用紫外线固化胶（UV胶）粘接晶体如果功率比较大晶体升温快热胀冷缩胶水可能脱胶然就就悲剧了胶合晶体极限功率200mw 而且稳定性很差  Bonding crystal. UV light adhesives are adopted to bond crystals. If the power is relatively large, the crystals will be heated up quickly, then that would be a tragic if adhesives may come unglued after expansion and contraction. The extreme power of agglutination crystal is 200mw and its stability is poor  光胶晶体对晶体接触端面进行特殊处理（估计是高度抛光）然后压在一起晶体会由于分子力结合这种晶体不会脱胶而且稳定性很高效率也比较高做300mw以下很好  Optical cement crystal. A special treatment is conducted to contact surface of crystals (estimated to be highly polished), then crystals will be pressed together, crystals after this treatment will not be easy to come unglued as molecular forces integrate and their stability are relatively high, good for lasers below 300mW  分离晶体 2个晶体分开放置独立散热可以承受很大功率缺点是晶体位置需要进行复杂的调节以达到最大输出而且结构复杂体积大价格贵  Separated crystal. 2 crystals are separately placed for independent cooling, it can withstand a great power. Its weaknesses is that complex adjustment is needed to change the crystal position to achieve the maximum output and it has complex structure, large volume and high cost |
| [不同波长光斑和光束亮度的对比](http://www.coolplaybar.com/thread-1160-1-1.html)  Comparison of brightness of light spot and beam among lasers of different wavelengths  经常有初烧坛友询问某功率445nm亮度相当于多少功率的532nm  Some beginners often ask me how much the power of 532nm laser equivalent to the brightness of 445nm laser is  这个问题并不容易回答因为每个人眼对各种波长光的敏感程度不同  The question may not be so easy to answer, because the sensitive degree of each eye to light of different wavelengths is not the same 而且在亮和暗的情况下感觉也不同  And the feelings will be also different in the dark and light conditions  科学家根据人眼在亮/暗环境视觉的平均值分别建立了明/暗视见函数  Scientists have established light / dark vision functions respectively according to the mean value of human vision in the light / dark environments  当亮度大于3cd/㎡时，为明视觉，锥体细胞起主要作用，V（λ）的峰值产生在550nm~560nm部位；光亮度小于0.03cd/㎡时，为暗视觉，杆体细胞起主要作用，V（λ）的峰值向短波方向移动，相当500~510nm的蓝绿色部位。亮度3到0.03之间的函数也在之间。  When the brightness is more than 3cd/㎡, it is a photopic vision, and pyramidal cells play a major role, peak value of V（λ）will be between 550nm~560nm; when the brightness is less than 0.03cd/㎡, it is a scotopic vision, rod cells play a major role, peak value of V（λ）shifts to short wavelength, equivalent to blue green parts between 500~510nm. Functions with brightness between 3~0.03 also appear in this position. |
| 首先讨论光斑亮度 光斑亮度在功率密度相同情况下基本就是由视觉函数决定  First let's discuss the spot brightness. Spot brightness is basically decided by visual function when the power and density are the same.  532nm在明和暗的情况下函数值都很高所以其亮度较高  The function value of 532nm is very high both in light and dark conditions, so it has relatively high brightness 而445nm在明暗条件下函数值相差数倍理论上白天亮度会很低而夜间效果不错  While the function value of 445nm is quite different in light and dark conditions, theoretically, the brightness is very low in daytime and has a good effect in night  但是实际上还需要考虑主光源的因素  But, in fact, we also need to consider the factor of the main light 比如说在太阳光下面观察光斑  For example, observe spots in the sunlight 这是太阳光的功率分布  This is the power distribution of sun light |
| 光斑亮度还取决于与光源的对比差值  Spot brightness also depends on the difference value of light source 像445nm 刚刚在太阳光谱的一个凹陷位置所以对比明显太阳光下观察亮度有所提升  Just like 445nm, it is in a depressed position of solar spectrum, so it has a obvious contrast that the brightness of observation under sunlight has improved |
| 接下来谈论光束亮度Next, let's talk about the beam brightness 光束亮度就不仅仅与视见函数有关还与散射率有很大关系  Beam brightness is not only related with vision function but also has a great relationship with the scattering rate.  就算是功率相同光束直径相同因为空气散射率不同就导致光束功率密度不一样  Even when they have the same power and beam diameter, because the air scattering rate is not the same, their power density will be different  大气散射分为多种类型 有些对短波散射厉害 有些对全波长散射基本一样  Atmospheric scattering is divided into various types, some have a stronger scattering to short wave, while some have basically the same scattering to full waves 所以这又加强了445nm这类短波的光束亮度但是这又导致远处的445nm光束损耗有所增加所以 445nm光束看起来经常是近处亮远处暗  So this has enhanced beam brightness of short wave like 445nm once again, but it has also increased the loss of distant 445nm beam, therefore, 445nm beam often looks bright up close and dark at a distance |
| 最后提醒注意自身和他人安全  Finally, I would like to remind of the safety of yourselves and others 确保光路以及可能反射产生的新光路没人任何人员  Ensure that there is no any personnel near light path or new light path that may be generated by reflection 不建议肉眼无防护近距离观察激光光斑  We are not recommending to observe laser spot up close with naked eyes without any protection |