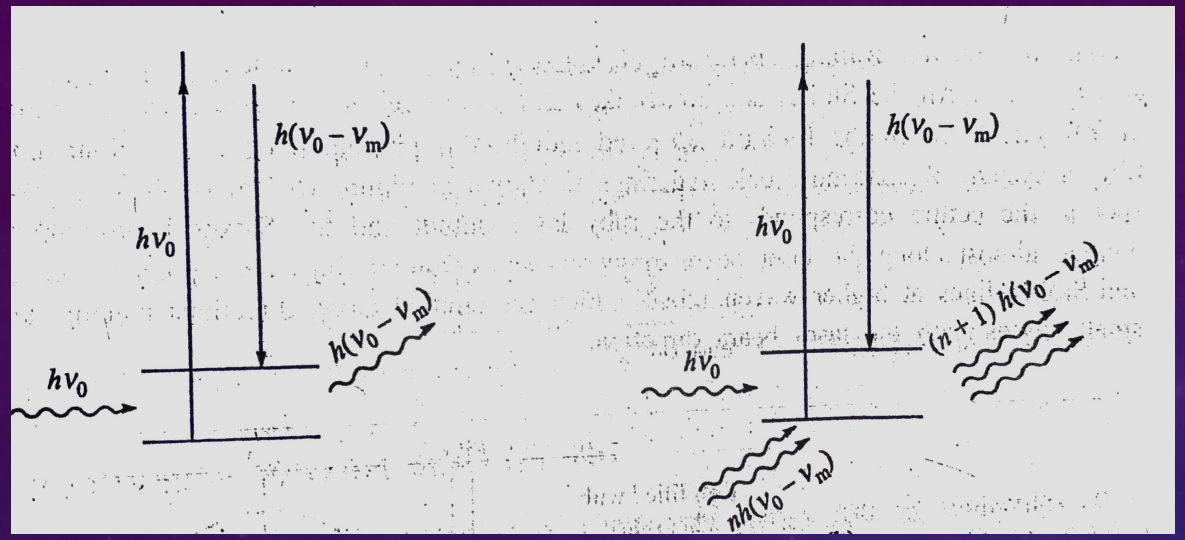
STIMULATED RAMAN SCATTERING

DR. L. ARUN JOSE

- The discovery of stimulated Raman scattering was accidental while experimenting nitrobenzene kerr cell as shutter for a q switched giant pulse ruby laser.
- In the output there was a intense radiation at in addition to the normal stimulated radiation.
- This additional emission a Raman line of nitrobenzene code number of characteristics of normal stimulated radiation radiation. When a giant pulse laser is focused into a sample and the scattered radiation is observed along the laser beam direction and at the small angles to it is found to consist of the incident frequency we and the Stokes and antistokes lines at v0 Where Vm corresponds to one Raman active vibration of the scattering molecule this phenomena is called stimulated Raman scattering
- It stimulated Raman scattering there is no need for population inversion of the states this nonlinear Raman technique is associated with the third order nonlinear polarizability.


$h(\nu_0 - \nu_m)$
$h\nu_0$
$h(\nu_0 - \nu_m)$
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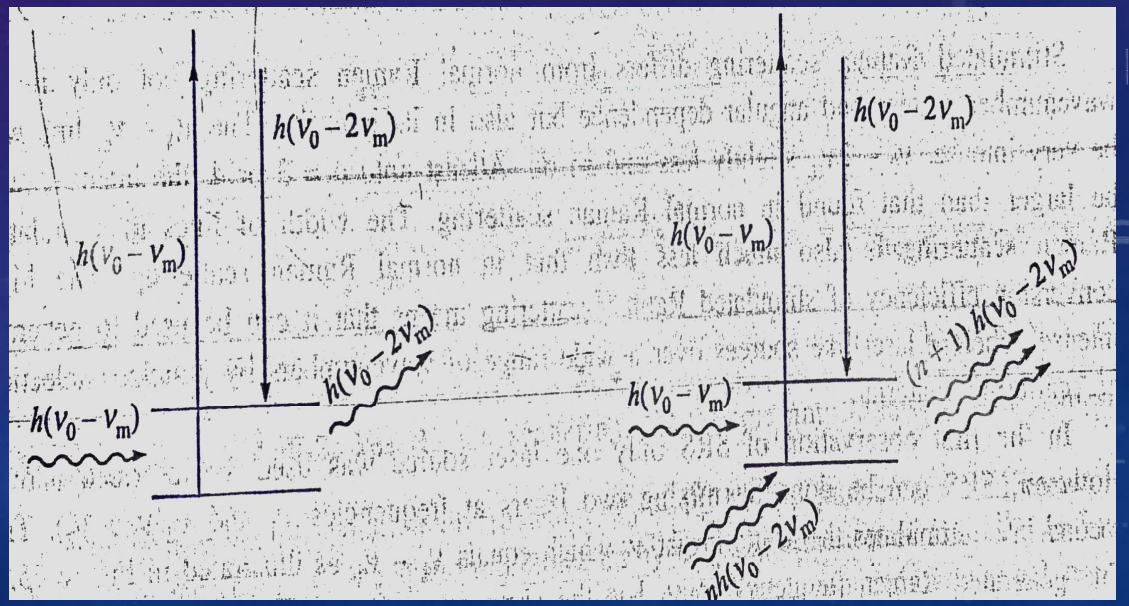
$h\nu_0$
$(n+1)\,h(\nu_0 - \nu_m)$
$nh(\nu_0 - \nu_m)$


$h(\nu_0 - 2\nu_m)$
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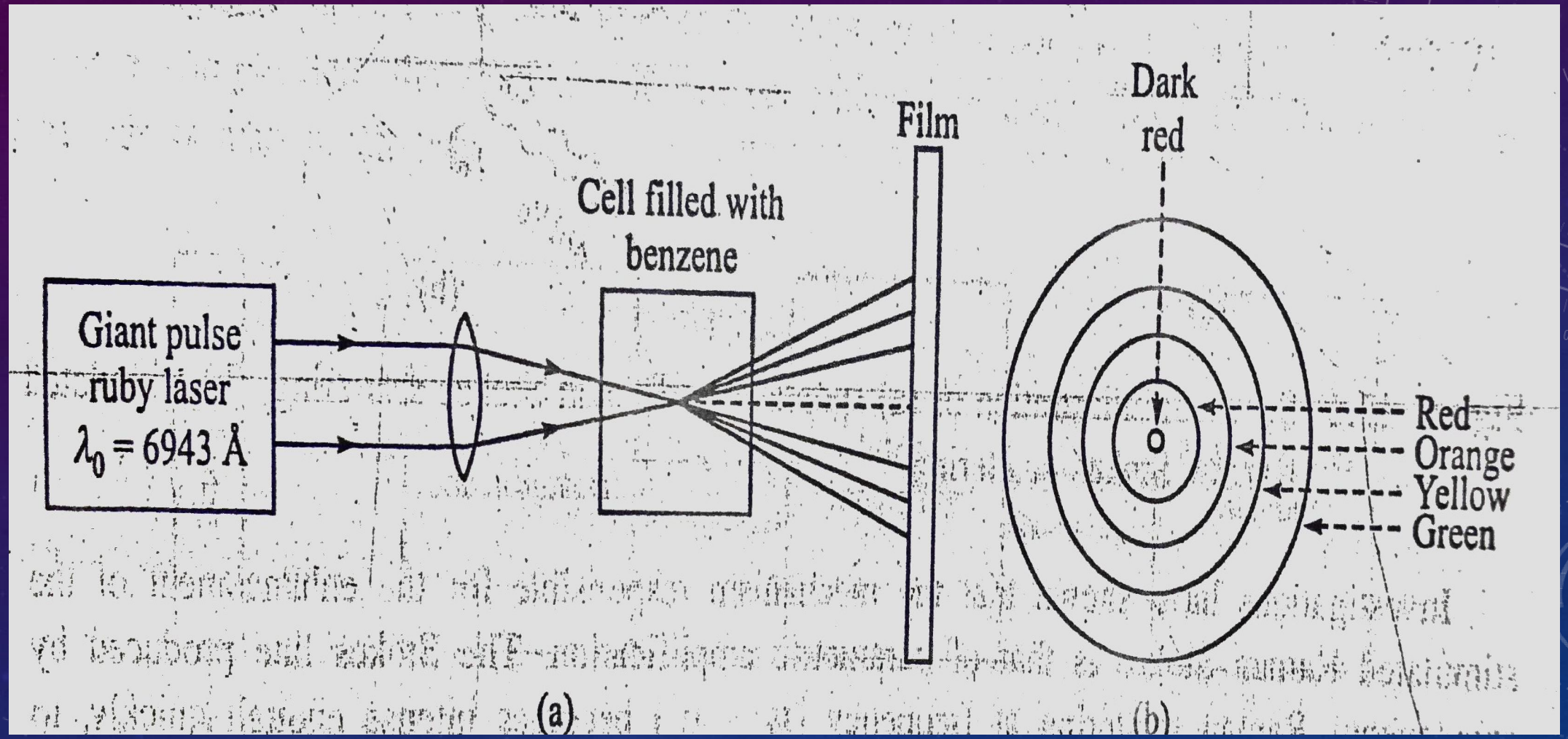
$h(\nu_0 - \nu_m)$
$h(\nu_0 - \nu_m)$
$(n+1)\,h(\nu_0 - 2\nu_m)$
$nh(\nu_0 - 2\nu_m)$

- A typical experimental arrangement for the observation of SRS is shown in the figure the laser radiation from my giant pulse ruby laser is focus the into the cell containing the benzene sample and the scattering is observed along the laser beam direction and that small angles to this direction in the normal Raman spectrum of benzene one of the intense banks is observed at 992 CM all the Stokes and antistokes shifts observed in the experiment and multiples of 900 and 92 CM then the forward scattered radiation is photographed on a colour sensitive film a system of concentric coloured ring shown in the figure is obtained the red spot at the centre corresponds to the ruby laser output and the strokes band which are emitted almost along the laser beam direction the coloured rings correspond two successive antistokes lines at Higher wave numbers which are emitted along directions making definite small girls with laser beam direction


Giant pulse
ruby laser
$\lambda_0 = 6943$ Å
Cell filled with
benzene
Film
Dark
red
Red
Orange
Yellow
Green
(a)
(b)

- Stimulated Raman scattering differ from normal Raman scattering not only its wave number pattern and angular dependence but also in its intensity
- The Vo – Vm line will be very intense Vo-2 Vm slightly less and so on at least upto n= 3 or 4 the intensity will be larger than that found in normal Raman scattering.
- The width of lines in stimulated Raman scattering is also much less than that in normal scattering the height conversion efficiency of stimulated Raman scattering means that it can be used to generate intense coherent laser light sources over a wide range of wave numbers by judicious selection of scattering material.

- In the first observation of SRS only one laser source was used as described above.
- However SRS can be done by mixing two lasers at frequencies V1 and V2.
- The second laser stimulates the scattering at V2 which = V1 – VM as illustrated in the figure.
- The generated Raman frequency at V2 has the same properties as the V2 laser during the process of again is produced at the frequency V2 was photons of frequency V1 are annihilated.
- Therefore there are two ways to perform the experiment aged by measuring the gain at the frequency V2 or by measuring losses at frequency V1.
- These two are sometimes referred to as Ram and gain Spectroscopy and ROM and lost respectively generally apples laser serves as the pump beam and a Cw Laser as the prob Beam.

THANK YOU.....