How Much IETS (indirect inelastic electron tunnelling spectroscopy) is effective to detect molecular temperature of extraterrestrial sources?

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With the burning of molecules in vapur phase like LiAsO and Li++AsO2 their spectral spectral bans display under restrained conditionn of J-V biasing tunnell current density in amount and direction cross over the barrers . there croosing action are reflected on to the spectrum as FEM band wavelength >10A ^{0}and frequency 1.8Mev released with (QV =hv) of range from .18 volt to 10.058Evolt with applied voltage on barriers yield charachteristic frequencies band.For specific molecules like $Li^{+2}As^2$or $Li^{+3}Ga^{+2}$oxides have specific spectral character which are in agreement with te available band of spectral lines of certain molecular character.

This display of molecular spectral band with available comosition of the environmentall history in terms of temperature and compostion.QFT and QED classics [1][6,24,25] supportingly agree to the confirmal detection level of characteristics of spectrum band produced qualifying the nature and status of the environment[2][3,5,6,24] prevailing.and hence add to the lambda CMB theory in BBN cosmology.

Key Words;QFT,QED, IETS, Spectroscopy ,Inelastictunnelling.Indirect electron Microscopy.

Introduction

Schrödinger wave equation to analyze the band spectrum by hot electron emission from the available molecular vapors3[25,6] in the environment are sufficient to explain the scattering and attenuated for wavelength and enhanced frequency of band obtained in the spectrum[4][6,25,23]Facts agree with the classics of QFT and QED with the current density obtained in the due to Enelastic tunneling of electron over the barrier junctions of different metal as MIMs junctions or PNP junction[5][3,25,13

].Index molecular composition of barriers subsequent to heating at certain temperature[6][2,4,6,25] up to 23^0k Alas , Zn As and other potential barriers in use normally are traditional chips in the use of tunneling effect.[8][6,23,24.] by the molecular stuff of $Li^{+}As^{+3}o_{2}$,,$Li^{++}As^{=2}o$ in place band spectrum at the frequency range of 1-to10evin the Eqauation

$$j = \frac{h}{2mi}[\psi\bullet\nabla\psi - \psi\nabla\psi] ---------------\quad --- \quad eqn \quad [1]$$

for the current density will display the probability of energy emitted and field set up after heating the barrier metal[9][4,6,24]Furher across the tunnel junction electron probability density within a rectangular barrier can be written as a It)= 1 at the by the following equation

$$\Psi\psi' = I\alpha I^2 \exp^{[-2x(x-x_1)]}+/\beta^2)I arI^2\exp[2x9x-x1)]+\alpha\beta^* ar^*(t)e^{i\omega rt}\_\_\_\_\_\_\ \_(2)$$ **[10][5,13,24,20]**

After differentiating the equation (2) w.r.t. time we get

$$\frac{\partial}{\partial t}(\psi\psi\hat{\ })=I\beta I^2\exp^{[2X(2X-X_1]}[\frac{d}{dt}ar(t)^2]+[-i\omega rt\alpha ar\hat{\ }(t)e^{-i\omega Irt}\_i\omega r\alpha\hat{\ }\beta ar(t)e\text{-}i\omega rt\text{----}(3)$$ **[10][3,4,14.]**

$$=E1+E2+E3\text{------------------}\quad\text{---------------------}(4)$$

Mechanism-To specify the temperature condition in association WITH prevailing environmental compostion (Chemical) electrons induced in access free outside or already available inside the enevirnment either loose or gain by energy while tunneling trough a potential barrier Jackerien and Lambe et.al.[11][4,6,13,24] vberational modes suitable condition.At semiconductor junction phonons' significantly open additional channel of tunnel current with due interactions of electrons with the phonons released sudden jump or drop takes place in tunnel current [12][2,5,6,16] values of the fundamental phonon energies in si that would conserve momentum in a tunneling transitions are tose at the direct band edge and TA (transverse acoustic) at 17.90 Mv the LA (longitudinal Q accoustics of 43.7 Mvthe LO longitudinal optic 53.4 mv and TA 58.5 mv .With the lowering of bias energy $h^{\wedge}\omega p$ of phonon electron emits a phonon and tunnel across the gap further at 300to 400k lowering the kinks in J_V characteristics due to phonon emission becomes prominent .it is found that for forward biases less than the peak voltage tunnel current Is the sum of three components in the core SI junction [13][3,5,6,24,25] hence further for the LI^{+} $As^{++}\leftrightarrow Si^{=3}$substitution junction will have similar demonstration first to tunnel current as without phonon participation at 18mv biases and TA assisted phonon only following current J1 starsts at 18 v & so total as J0+j1 as current observed j2 AS TOTAL AS CURRENT OBSERVED KJ2AS THIRD COMPONENT ADD TO PHONON ASSISTED TUNNELING.

Total current J0+J1+J2 was derived by Logan and Chynotan[14][3,6,8,10,22] who later predicted by kane featured shape of wave produced .

For different Characteristics of line of variation of J0 for J0+J1 in J1 IV-0.0018against Vplot and in j2IV-0.0580 against vlinearirity was obtained which is qualitative agreement on theory and experiment mathematical approval in indirect tunneling current for wave function in the P-N junction is written as

$\Psi=\sum_n \sum_k An(K)bn(rK)$--[15][12,14,17,19](4)

Where bn (rK)= exp (iKr) UnK are Bloch functions of wave rector k and bind n it can be wshown that in the presence of of an electric field E the expansion coefficient An (k)-ie $\sum \frac{\partial}{\partial k11} - E]An\,(k\rightarrow) - \sum_n eEXnnAn(K\rightarrow) = 0 - - - - - - \quad (5)$[16][4,6,18,22]

Where E11(k→) is the energy as a function of $(k^{\rightarrow})$in the nth band of the unperturbed crystal .droping the interband hen uncouples auAn and we have n in the independent equations with the solutions as

An $({}_kK\rightarrow)$ = $x^{1/2}$2αIIexp $\{\frac{i}{\epsilon\xi}\int_0^{kII} E - E_{Ir}(k^{-1})]\, dk_{II}\}\partial(K$I-KIr)----------------------------(6)[17][13,21,25,26]

Where X is the normalization constant and α_n a constant which may be chosen differently for each value of n we have n independent functions of Bloch functions in each of the n bands. Within a single band each function os made up of Bloch functions .since an electron goes from the wave lead on the nit it gives into a definite band then is scattered by some mechanism either an electron –phonon scattering[18][14,16,22,24] or the interband then dropped from the equation (3)or a combination of bothin the same definite band on the left side of the junction. Rate between right and left hand side one can calculate the current in P_N junction .by virtue of Blourfine and Kane Phonon assisted tunneling[19][2,14,24,26] will present current in accuracy will result .in Wanner representation in the tunnels may be defined

ωIr$(r^{\rightarrow}k^{\rightarrow})$= $N^{1/2}V(2\pi)^{-3}\int_z\ exp(-ikR)k^{\rightarrow\rightarrow}$R)bn$(R^{\rightarrow K^{\rightarrow}})$[20][23,24,26]------------------------------(7)

where the integration is overall $k^{\rightarrow}$in Brillouwin zone and → is a lattice vector which after conversion is bn$(rk^{\rightarrow})$= $N^{1/2}$[R1 exp (i$k^{\rightarrow}R^{\rightarrow}{}_I$)ω$(r^{\rightarrow}K)$ ------------- --(8)

Which is concepting part of Bloch function in a single band and we localize in real space about the lattice point binding Eigene function and are then given as

$\psi_n(r^{\rightarrow}) = E_{r^{-}}{}^{\beta I}(R)\ \omega_n(r\,R)$---------------------------- ----------------(9)[21][12,14,17,19]

Which after multiplication by kliein as wave function becomes

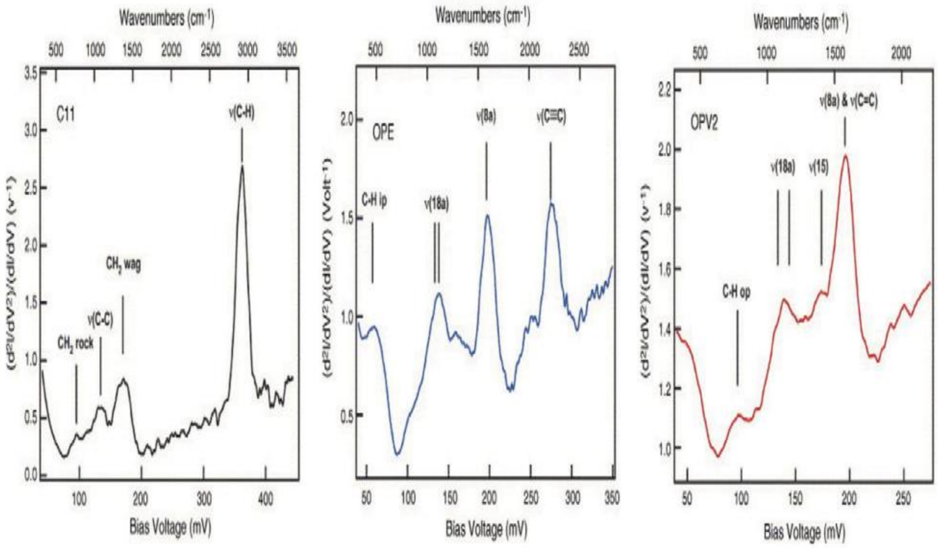
$\Psi n(r) = ER^{\rightarrow}\ \beta I®\partial I(r^{\rightarrow} - R^{\rightarrow})Une\ (r^{\rightarrow})=\beta(r^{\rightarrow})Un\infty(r^{\rightarrow})$-------------------------(10)[22][12,16,18,22]

Thus the current due to scattering TA phonon becomes the styatyes τ_{2s} $(k^{\rightarrow}{}_{2S})$and L1 is obtained as

$J=\frac{2\pi q}{h}\sum k\tau_{2s}\sum k_I\xi phonon\psi L((k^{\rightarrow}{}_{LI}h\tau AI\psi\tau_{2s}K^{\rightarrow}\tau_{2s}).>RX(\tau lII l_{\tau 2s})\partial(E_{LI})-E_{\tau 2s}+h\omega$-----(11)[23][12,14]

Where ħω holds the h postitive or negative voltage in the energy conservation say ∂function $\mathsf{F}_{LI/2s}$The unit current in the tunneling was 250 times greater than the experimetal observation .and apply to the LApphoo assisted tunneling which yielded 100 times too small.

Keiman considered Γ_{2s} electron tunnels into the $\Gamma_2$state via the interband term. This is against the principle of energy ccoservatio.which emits the electron and scatter into L1 state



a. Figure1

above displays the variation of bias voltage against the generated voltage density and wave length corresponding spectrum shall have inference. Courtsey: Mark A. Reed *Yale University, New Haven, CT 06520, USA.l*

Hamiltonian Kane model is

Which Eugine values $E=1/2\ \Delta\Gamma+\frac{h2\ k2}{2m}+1/2\eta$)---(11a)

Where $\eta=[\Delta\Gamma^2+\Delta\Gamma\frac{h2\ k2}{m\Omega})]^{1/2}$---------- ---(11b)[25][15,18,20,24]

And, $m_\Gamma^{-1}=m_{\tau 2s}-1+m_\Gamma^{-1}$-- ----(11C)

While Eugine function becomes

$UK^{\Gamma 2}=(2n)^{-1/2}\{(n+\Delta_\Gamma)^{1/2}U_0\ \Gamma_2+(n-\Delta_\Gamma)^{1/2}U_0\ \Gamma^{2s}\}$-------------------------------- ---(12)[26][13,14,18,22]

$K^{\Gamma 2s}=(2n)^{-1/2}\{(n+\Delta_\Gamma)^{1/2}U_0\ \Gamma_2+(n-\Delta_\Gamma)^{1/2}U_0\ \Gamma_2(n-\Delta_\Gamma)^{1/2}U_0\ \Gamma^{2s}\}$------------------------- -(13)

After substitution of v's in equation (7,8) we have

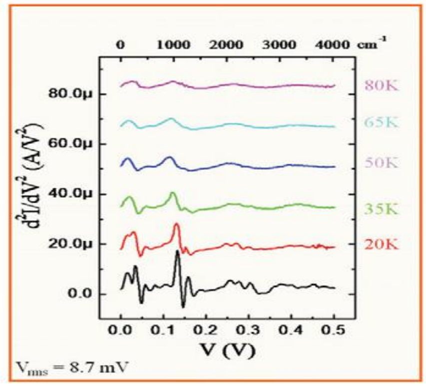
$X\ \Gamma_2\ \Gamma_{2s}=ih\Delta\ \Gamma^{3/2}/2m_\Gamma^{1/2}n^{1/2}$-- ------(13a)

Thus the interband matrix in crystal matter representation is

$(K^{\rightarrow})=e^{\Gamma}\int^{A}A_{\Gamma 2}(k\rightarrow X\ \Gamma_2\not\Gamma_{2s}A\ \Gamma_{2s}(K\rightarrow)d^3K^{\wedge}$------------------------------------ (13c)[27][22,24,18.]

which is weinners' representation

$M\ (K^{\rightarrow})=e=\sum\ A\ \Gamma\beta_{\Gamma 2}(\rho^{\rightarrow})X(2\partial/\partial\rho_{II}$---(14)



Where `A is junction constant. Figure2

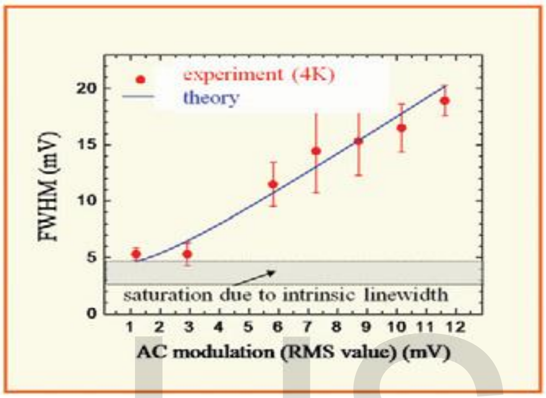
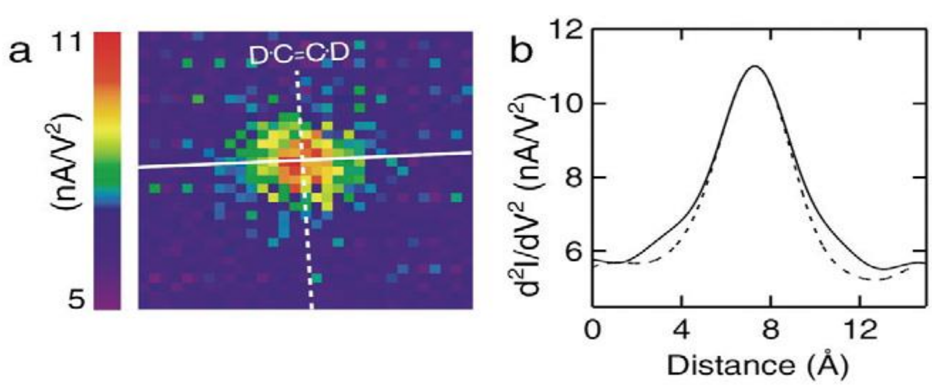


Figure3: Figure 2and 3 **IETS of a molecular junction. (a) Simultaneous current–voltage (I–V), dI/dV, and d2I/dV² corresponding to molecular vibrations. (b) (Upper) Schematic illustration of a crossed-wired tunnel junction. The Lorentz force generated from idef and the applied magnetic field B is used to bring the two wires gently together.(Lower) The structure of the molecule (From Troisi et al.)**

Discussion: various LO and TO phonons interaction with electrons in Ga As and Alas has reproduce 36.2mv and 50.1 mv.Coupling between electron qand phonon does not occur rather dispersion is experienced at symmetric interface as

$\dot{\epsilon}_2^2 \tanh(q_{\parallel} d_2) + \dot{\epsilon}_1 \dot{\epsilon}_2 [\tanh(1/2 q_1 d_1)$ --**(15)**[28][3,7,18,22.]

Where , $\dot{\epsilon}_1$ $\dot{\epsilon}_2$ are the dielectric constant for well (GaAs)and barriers (AlAs) Respectively.



Vibrational microscopy of DCαCD. (a) Spenergy of the C–D stretch mode (266 meV) showing localized excitation of molecular vibration (14 × 14 Å2). The solid line contains the C–C

ISSN 2229-5518

bond axis,and the dashed line is perpendicular to it. (b) Smoothed cross-sections of (a)
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.Substitution of Ga and Al withb Li+ and Li^{++} as doping in the barrier structure will provide chemically and physically similar result as before in the display of spectrum of wave band in terms of obtained wave length and frequency.which agrees the Schrödinger equation. FOR LONGITUDINAL AND TRANSVERSE inequality $Hq_{II}d_{2\rightarrow}$ LO and TO phonon energy.plot of $q_{II}d_2$
for LO like interface in a structure with $80A^0$ GaAs will act as $33A^0$~AlAs barrier metal.

Discussive conclusion: Electron potential energy under influence of agents (external)

may indirect smaller time dependent perturbant as Barrier Hamiltonian or Barrier wave function as

$V(x)=V_{1(x)}+V_3Cos\varpi\rho t$------------------------------- -------------------------- ------------------(16)29[3,5,18,25]

WhereV1(x) electron potential energy and depends on the barriers' shape and term $V_3Cos\varpi\rho t$ is the time dependent electron perturbation introduced by the external agent in the tunneling system.Whih is Hamiltonian form expressed as

$H= h^2//2mc^2\,\Gamma+V(xt)$-------------------------------------- -------------(17)[30][5,7,9,14,25]

$= \{- h^2//2m\frac{}{\partial X2}\,\partial^2\,\Gamma+V_1(x)\}+V_3cos\varpi\rho t$--(17b)

$=H_0+H_1(t)$------------------------------------ -----------------(17c)

Whereas H0 unperturbed and $H1(t)= V_3cos\varpi\rho t$ in absence of perturbation electron satisfies the Schrodinger's equation.

$H_0\psi_0(x_1t)=ih\frac{}{\partial I}\,\partial\psi_0xt)$---(18)

Where $\psi_0xt) = Ꭓ(x)\digamma,(t)$--(19)

Putting the term from equation (17) in equation 14 we get

$- h^2//2m\frac{}{X(x)}\quad \partial^{2X(x)}\psi/^{dx2}\,V1(x) = \frac{ih\,\partial T}{\Gamma(t)\partial t}$---(20)

Where E is the total electron energy in the incident end subsequent to analytical processing of equations formations ,we conclude pwerturbed wave function as

[ψ(x1,t)=b1(t)(x)exponential (-iϖt) ⎾br(τ)Ꭓr+(⎾exp(-ϖrt)

Whereb1(t)brt are density depreciation to be determined in the spectrum.

Summarisingly we put conclusion as

which may lead to nonlinear phenomena such as bistability, hysteresis, switching and Negative Differential Resistance (NDR).

3. Understanding heat generation and dissipation on the molecular scale.

4. The understanding of current-induced reactions, and insights via conformational changes.

5. Development of quantitative computational methods in the strong coupling regime. When polarization, photonic, or correlation effects are present, only model calculations are available today. A challenging theoretical problem is extension of these formal techniques to allow accurate numerical predictions. Over the last few years, IETS has evolved into an essential tool in the understanding and validation of molecular junctions. It is anticipated that the usefulness will grow with the

development of improved fabrication techniques (guided in part by IETS results), and lead to pioneering understanding of the more difficult regime of no equilibrium, strong coupling transport.

Acknowledgments

We are thankful to the Department of Physics T M Bhagalpur University to provide thesis on similar topic.

2 We must pay thankful regards toMark A. Reed Yale University, New Haven, CT 06520, USA for citation of his research note.

3We must pay thanks to Indirect and direct way are helpful in enriching the wealth of the Paper by review work.

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